No. 95-813

In The

Supreme Court of the United States

October Term, 1995

BRAD BENNETT, et al.,

Petitioners,

vs.

MARVIN PLENERT, et al.,

Respondents.

On Writ Of Certiorari
To The United States Court Of Appeals
For The Ninth Circuit

JOINT APPENDIX

BEST BEST & KRIEGER LLP
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Petition For Certiorari Filed November 21, 1995
Certiorari Granted March 25, 1996

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STATEMENT OF RELEVANT DOCKET ENTRIES

EXHIBIT "A" (To Complaint for
Declaratory and Injunctive Relief)

60 DAY WRITTEN NOTICE OF VIOLATION
NOTICE OF INTENT TO SUE
16 U.S.C. SECTION 1540(g)(2)(A)
Via Registered Mailings (RRR) to:

Secretary, United States Department of the Interior
Office of the Secretary
Washington, DC 20240; and
Director, U.S. Fish & Wildlife Service
U.S. Department of the Interior
Washington, DC 20240; and
Regional Director, United States Fish & Wildlife Service
Regional Office, Region 1
500 NE Multnomah Street, Suite 1692
Portland, Or 97232; and
Commissioner, Bureau of Reclamation
U.S. Department of the Interior
Washington, D.C. 20240; and
Regional Director, Pacific Northwest Region,
Bureau of Reclamation
Federal Building, United States Courthouse,
550 W. Fort Street,
Boise, ID 83724-0043; and
Regional Director, Mid-Pacific Region
Bureau of Reclamation
Federal Office Building
2800 Cottage Way
Sacramento, CA 95825.

NOTICE IS HEREBY GIVEN on behalf of Brad Bennett, an individual, Frank and Linda Hammerich, individually and as Husband and Wife, Mario Giordano, an individual, and Langell Valley Irrigation District and Horsefly Irrigation District, both political subdivisions of the State

of Oregon, (all hereinafter called "Notifiers") that they intend to bring suit against the above named parties or some of them for violations of the Endangered Species Act of 1973, 16 U.S.C. Sections 1531 to 1544 (hereinafter "ESA"). The claims of said parties are more particularly described in a document entitled, "Complaint for Declaratory and Injunctive Relief" which is attached hereto and incorporated herein as Exhibit "A". Notwithstanding the caption of Exhibit A, said document has not yet been filed in any Court, and is exhibited by this Notice only for the purpose of identifying the persons giving this notice, their lawyers, and stating their claims.

The continued violation or violation of the provisions of the ESA as set forth, will result in the filing of said Complaint or a substantially similar one, pursuant to 16 U.S.C. Section 1540(g)(2)(A).

The names, mailing addresses and telephone numbers of the Notifiers are:

Brad Bennett, P.O. Box 216, Bonanza, OR 97623, (503) 545-6062;

Frank and Linda Hammerich, 15666 E. Langell Valley Rd., Bonanza, OR 97623, (503) 545-6620;

Mario Giordano, 11431 W. Langell Valley Rd., Bonanza, OR 97623, (503) 545-6206;

Langell Valley Irrigation District, 9787 E. Langell Valley Rd. Bonanza, OR, (503) 545-6344;

Horsefly Irrigation District, P.O. Box 188, Bonanza, OR 97623, (503) 545-6474.

This Notice is given by the undersigned on behalf of the Notifiers, and the addresses and telephone numbers of the undersigned are stated within Exhibit A.

Dated: November 12, 1992.

William F. Schroeder, Esq.
John T. Schroeder, Esq.
Larry A. Sullivan, Esq.
W. Alan Schroeder. Esq.

By /s/ W. F. Schroeder
Lawyers for Notifiers.

EXHIBIT A (To 60 Day Written Notice)

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Lawyers for Plaintiffs.

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF OREGON

BRAD BENNETT, an individual; FRANK HAMMERICH and LINDA HAMMERICH, individually and as Husband and Wife; MARIO GIORDANO, an individual; LANGELL VALLEY IRRIGATION DISTRICT, a political sub-division of the State of Oregon; HORSEFLY IRRIGATION DISTRICT, a political sub-division of the State of Oregon,	)	Case No.
Plaintiffs,	)	
vs.	)	

MARVIN PLENERT, in his official capacity as Regional Director, Region One, Fish and Wildlife Service, United States Department of the Interior; JOHN F. TURNER, in his official capacity as Director, Fish and Wildlife Service, United States Department of the Interior; and MANUEL LUJAN, in his official capacity as Secretary, United States Department of the Interior,

Defendants.

) COMPLAINT
) FOR
) DECLARATORY
) AND
) INJUNCTIVE
) RELIEF

PRELIMINARY STATEMENT

1. This is an action for declaratory judgment. Plaintiffs seek to compel Defendants to withdraw portions of the biological opinion issued by the Fish and Wildlife Service on July 22, 1992, ("the Biological Opinion"), pursuant to the agency consultation provisions of the Endangered Species Act ("ESA"). A copy of the Biological Opinion is attached hereto and incorporated herein as Exhibit A. The Biological Opinion improperly concludes that continued operation of Clear Lake reservoir in northern California and Gerber reservoir in southern Oregon by the Bureau of Reclamation ("BOR") jeopardizes two endangered species, the Lost River sucker and the shortnose sucker. As a consequence of its erroneous jeopardy conclusion, the Biological Opinion improperly seeks to impose restrictions on the BOR's operation of Clear Lake reservoir and Gerber reservoir. In addition, critical habitat for the Lost River sucker and the shortnose sucker has never been determined by defendants, and these restrictions are invalid for that reason as well. On information and belief, Plaintiffs allege that the BOR will abide by the restrictions imposed by the Biological Opinion.

2. This action arises under and alleges violations of the ESA, 16 U.S.C. §§ 1531 *et seq.*, and its implementing regulations, 50 C.F.R. Part 402, and the Administrative Procedure Act (the "APA"), 5 U.S.C. §§ 551 *et seq.*

JURISDICTION AND VENUE

3. Jurisdiction over this action is conferred by 16 U.S.C. § 1540 (g)(1)(C) (ESA citizens' suit) and 28 U.S.C. U.S.C. §§ 1331 (federal question), and 2201 (declaratory relief). A copy of plaintiffs' 60-day Notice of Intent to Sue, dated October 26, 1992, is attached hereto as Exhibit B.

4. Venue is properly in this Court pursuant to 28 U.S.C. § 1391(e), as some or all of the plaintiffs reside in this district and a substantial part of the events or omissions giving rise to the claim occurred in this district.

PARTIES

5. The plaintiffs in this action are:

A. Brad Bennett ("Bennett"), a rancher who resides near Bonanza, Oregon, and who receives most of his irrigation water from Clear Lake reservoir. Brad Bennett's ranch is located within the Horsefly Irrigation District.

B. Frank and Linda Hammerich ("Hammerich"), ranchers who reside near Bonanza, Oregon, and who

receive irrigation water from Gerber reservoir. The Hammerich ranch is located within the Langell Valley Irrigation District.

C. Mario Giordano ("Giordano"), a rancher who resides near Bonanza, Oregon, and who receives irrigation water from Clear Lake reservoir. Mario Giordano's ranch is located within the Langell Valley Irrigation District.

D. Horsefly Irrigation District ("HID") is a political subdivision of the State of Oregon organized pursuant to Oregon Revised Statutes chapter 545 for the purpose of delivering irrigation water to its patrons within the District. The District is located in Klamath County, Oregon, and it receives irrigation water from Clear Lake reservoir in northern California via the Lost River, pursuant to contracts with the United States. The District office is located in Oregon in the town of Bonanza.

E. Langell Valley Irrigation District ("LVID") is a political subdivision of the State of Oregon organized pursuant to Oregon Revised Statutes chapter 545 for the purpose of delivering irrigation water to its patrons within the District. The District is located in Klamath County, Oregon, and it receives irrigation water from Gerber reservoir via Miller Creek and Clear Lake reservoir in northern California via Lost River, pursuant to contracts with the United States. The District office is located in Oregon near the town of Bonanza, Oregon.

6. Plaintiffs use Gerber reservoir, Clear Lake reservoir, Miller Creek, and Lost River for recreational, aesthetic and commercial purposes, as well as for their primary sources of irrigation water. Plaintiffs' use of

Clear Lake reservoir, Gerber reservoir, Miller Creek, and Lost River will be irreparably damaged by defendants' disregard of their statutory duties, as described below, and by the unlawful restrictions placed by defendants on the use of Clear Lake reservoir and Gerber reservoir.

7. Unless the relief prayed for herein is granted, the above-described recreational, aesthetic and commercial interests of plaintiffs will be adversely affected and irreparably injured by the erroneous conclusion of defendants that the BOR's continued operation of Clear Lake reservoir and Gerber reservoir will likely jeopardize the survival of the Lost River sucker and the shortnose sucker unless restrictions are placed on such operation.

8. The defendants in this action are:

A. Marvin Plenert, in his official capacity as director of Region One of the Fish and Wildlife Service, United States Department of the Interior. Region One of the Fish and Wildlife Service includes Clear Lake reservoir and Gerber reservoir. The Biological Opinion was issued by the Region One office of the Fish and Wildlife Service.

B. John F. Turner is the Director of the Fish and Wildlife Service, United States Department of the Interior.

C. Manuel Lujan is the Secretary of the United States Department of the Interior (the "Secretary"). The Secretary is empowered by the ESA to make jeopardy determinations concerning threatened and endangered species pursuant to 16 U.S.C. § 1536(b)(3)(A).

FACTS

9. Clear Lake reservoir and Gerber reservoir were constructed early in the twentieth century in the eastern portion of the Klamath Project by the BOR to provide irrigation water to farmers and ranchers in southern Oregon. Although Clear Lake reservoir and Gerber reservoir are part of BOR's Klamath Project, they are operated separate and distinct from the western portion of the Klamath Project, which consists of the Klamath River and Upper Klamath Lake in Oregon and Lower Klamath Lake and Tule Lake in California. A diagram showing the bodies of water in the Klamath Project is attached hereto as Exhibit C. The separated systems are different aquariums and aquatic animals within the one cannot naturally move to the other.

10. The Lost River sucker and the shortnose sucker were declared endangered under the ESA in 1988 (53 C.F.R. 27130-27135). Both species have been found in the various bodies of water of the Klamath Project, including Clear Lake reservoir, but only the shortnose sucker has been found in Gerber reservoir.

11. Critical habitat for these species of suckers has never been determined by the Secretary, despite the ESA's mandate that he do so "to the maximum extent prudent and determinable" under 16 U.S.C. § 1533(a)(3) at the same time the Secretary declares them endangered. Defendants are responsible for determining critical habitat.

12. The BOR has been following essentially the same procedures for storing and releasing water from

Clear Lake and Gerber reservoirs throughout the twentieth century, up to the present day. No natural phenomenon or human activity has substantially modified the aquatic environments of Gerber reservoir and Clear Lake reservoir since their construction except that the Department of Fish & Game of the State of California installed the Sacramento Perch within the Clear Lake Reservoir.

13. There is no scientifically or commercially available evidence indicating that the populations of endangered suckers in Clear Lake and Gerber reservoirs have declined, are declining, or will decline as a result of any natural phenomena or human activities, including the operations of the BOR in the Klamath Project. To the contrary, the scientifically and commercially available evidence indicates that the populations of endangered suckers in Clear Lake and Gerber reservoirs are not declining and are reproducing successfully.

14. As a result of concerns over population declines of the endangered suckers in the Klamath River system in the western portion of the Klamath Project, the BOR initiated consultation with the Fish and Wildlife Service in 1990 pursuant to section 7 of the ESA, 16 U.S.C. § 1536. The Biological Opinion is the result of that consultation and was issued pursuant to section 7(b)(3)(a) of the ESA, 16 U.S.C. § 1536(b)(3)(a).

15. The Biological Opinion makes the following conclusion:

> Biological Opinion
>
> It is our biological opinion that the long-term operation of the Klamath Project as described under the *Description of the Proposed Action*, is

> likely to jeopardize the continued existence of the Lost River and shortnose suckers. It is our biological opinion that the proposed Project operation is not likely to jeopardize the continued existence of the bald eagle. Critical habitat has not been designated for any of these three species.

p.2.

16. The Biological Opinion notes that "Both Lost River and shortnose suckers are long-lived, highly fecund, and well adapted to surviving drought conditions." (Biological Opinion, p. 18). The Biological Opinion points out that sucker habitat in Clear Lake differs from that in the western portion of the Project, at Klamath Lake and Upper Klamath Lake, "because Clear Lake appears to have relatively stable sucker populations, has virtually no aquatic vegetation, and exhibits wider fluctuations in lake elevations during most years." (Biological Opinion, p. 18). The Biological Opinion attributes the stability of the sucker populations in Clear Lake to its good water quality, in comparison to the poor water quality in Klamath Lake and Upper Klamath Lake, where sucker populations have declined. (Biological Opinion, p. 18).

17. The Biological Opinion admits that little is known about the endangered sucker population in Gerber reservoir, although a study in May of 1992 found over 200 shortnose suckers with a broad range in size, " . . . which indicates that the population of shortnose suckers in Gerber reservoir has successfully recruited in the last few years . . . " (Biological Opinion, p. 20). The May 1992 study also found some evidence of stress in the

collected specimens, possibly due to low reservoir levels. (Biological Opinion, p. 20). The Biological Opinion notes that 1992 was one of a series of low water years, and that the 17-foot depth of Gerber reservoir at its lowest level, likely to be reached in October, 1992, should be sufficient to maintain a population of suckers. (Biological Opinion, p. 20).

18. Without any supporting citations, the Biological Opinion states:

> Formally *(sic)* stable populations, such as those in Clear Lake, are now threatened by drought related stresses. Without proposed improvements in water quality and sucker habitat, the future of these suckers is imperiled and the present status of habitat condition makes extinction in most of their current range highly likely.

p. 26.

19. Despite its conclusion that both Clear Lake and Gerber reservoirs have stable populations of endangered suckers which are reproducing successfully during the present drought years, the Biological Opinion imposes restrictions on the withdrawal of water from both reservoirs. Except for compromise years, the restrictions applicable to Clear Lake reservoir include a minimum lake level of 4524.0 feet between February 1 and April 15 annually, during the spawning season, and a minimum lake level or 4523.0 feet during the remainder of the year. (Biological Opinion, at 37). Except for compromise years, the restrictions applicable to Gerber reservoir permit no water releases below 4799.6 feet. (Biological Opinion, at 38).

20. There is no commercially or scientifically available evidence indicating that the restrictions on lake levels imposed in the Biological Opinion will have any beneficial effect on the stable, successfully reproducing populations of suckers in Clear Lake and Gerber reservoirs.

21. The restrictions on lake levels imposed in the Biological Opinion adversely affect plaintiffs by substantially reducing the quantity of available irrigation water.

22. By imposing restrictions on lake levels in Clear Lake and Gerber Reservoirs, the Biological Opinion implicitly determines critical habitat for the endangered suckers. The Biological Opinion does not take into consideration the economic impact of that determination, as required by § 4 of the ESA, 16 U.S.C. § 1533(b)(2). There is abundant commercially and scientifically available evidence as to the substantial negative economic impact of designating the critical habitat of the endangered suckers at the lake levels set by the Biological Opinion.

CLAIMS FOR RELIEF
FIRST CLAIM FOR RELIEF
VIOLATION OF THE ENDANGERED SPECIES ACT
VIOLATION OF THE ADMINISTRATIVE PROCEDURE ACT

1. Plaintiffs reallege paragraphs 1 through 22 above.

2. Defendants have violated § 7 of the ESA, 16 U.S.C. § 1536, and its implementing regulations, 50 C.F.R. Part 402, by improperly concluding on page 2 of the Biological Opinion that the BOR's continued operation of the Klamath Project, including Clear Lake and Gerber

reservoirs, is likely to jeopardize the continued existence of the Lost River and shortnose suckers. Defendants' violation of the ESA is subject to judicial review under section 11(g) of the ESA, 16 U.S.C. § 1540(g)(1)(C).

3. Defendants' inclusion of Clear Lake and Gerber reservoirs in its jeopardy opinion is arbitrary, capricious, and an abuse of discretion, and violates the APA, 5 U.S.C. § 706(2)(A). Defendants' violation of the APA is subject to judicial review under 5 U.S.C. § 701 *et seq.*

SECOND CLAIM FOR RELIEF
VIOLATION OF THE ENDANGERED SPECIES ACT
VIOLATION OF THE ADMINISTRATIVE PROCEDURE ACT

1. Plaintiffs reallege paragraphs 1 through 22 above.

2. Defendants have violated § 7 of the ESA, 16 U.S.C. § 1536, and its implementing regulations, 50 C.F.R. Part 402, by improperly imposing restrictions on the withdrawal of irrigation water from Clear Lake and Gerber reservoirs, as specifically set forth in paragraph 19 above. Defendants' violation of the ESA is subject to judicial review under section 11(g) of the ESA, 16 U.S.C. § 1540(g)(1)(C).

3. Defendants' imposition of restrictions on the withdrawal of irrigation water from Clear Lake and Gerber reservoirs is arbitrary, capricious, and an abuse of discretion, and violates the APA, 5 U.S.C. § 706(2)(A). Defendants' violation of the APA is subject to judicial review under 5 U.S.C. § 701 *et seq.*

THIRD CLAIM FOR RELIEF
VIOLATION OF THE ENDANGERED SPECIES ACT
VIOLATION OF THE ADMINISTRATIVE PROCEDURE ACT

1. Plaintiffs reallege paragraphs 1 through 22 above.

2. Defendants have violated § 4 of the ESA, 16 U.S.C. § 1533(b)(2), and its implementing regulations, 50 C.F.R. Part 402, by implicitly determining critical habitat for the Lost River suckers and the shortnose suckers in Clear Lake and Gerber reservoirs, as more specifically alleged in paragraph 21 above, without considering the economic impact of that determination. Defendants' violation of the ESA is subject to judicial review under section 11(g) of the ESA, 16 U.S.C. § 1540(g)(1)(C).

3. Defendants' failure to consider the economic impact of its critical habitat determination is arbitrary, capricious, and an abuse of discretion, and violates the APA, 5 U.S.C. § 706(2)(A). Defendants' violation of the APA is subject to judicial review under 5 U.S.C. § 701 *et seq.*

PRAYER FOR RELIEF

WHEREFORE, plaintiffs request the Court to:

A. Adjudge and declare that defendants have violated the Endangered Species Act and the Administrative Procedure Act by including Clear Lake reservoir and Gerber reservoir in the jeopardy conclusion on page 2 of the Biological Opinion of July 22, 1992.

B. Adjudge and declare that defendants have violated the Endangered Species Act and the

Administrative Procedure Act by improperly imposing restrictions on the withdrawal of irrigation water from Clear Lake and Gerber reservoirs in the Biological Opinion of July 22, 1992.

C. Adjudge and declare that defendants have violated the Endangered Species Act and the Administrative Procedure Act by implicitly determining critical habitat for the Lost River suckers and the shortnose suckers in Clear Lake and Gerber reservoirs in the Biological Opinion of July 22, 1992, without considering the economic impact of that determination.

D. Set aside the Biological Opinion of July 22, 1992, as unlawful and void of force under the ESA and the APA.

E. Award plaintiffs their reasonable fees, costs and disbursements, including attorney fees.

F. Grant plaintiffs such further and additional relief as the Court may deem just and proper, including injunctive relief pursuant to 16 U.S.C. Section 1540(g)(1)(A) to implement the foregoing.

Dated:

William F. Schroeder,
Larry A. Sullivan,
John T. Schroeder,
W. Alan Schroeder.

By _____
W.F. Schroeder
Plaintiffs' lawyers.

EXHIBIT B (To Complaint for
Declaratory and Injunctive Relief)

[SEAL]

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

911 N.E. 11th Avenue
Portland, Oregon 97232-4181

In Reply Refer To: JUL 22 1992
1-1-92-F-34

Memorandum

To: Regional Director, Bureau of Reclamation
Sacramento, California

From: Regional Director, Fish and Wildlife Service
Region 1, Portland, Oregon

Subject: Formal Consultation on the Effects of the Long-term Operation of the Klamath Project on the Lost River Sucker, Shortnose Sucker, Bald Eagle, and American Peregrine Falcon

Introduction:

This biological opinion has been prepared pursuant to the United States Department of the Interior Agreement on compliance with the Endangered Species Act dated June 11, 1991. This agreement is considered a request for formal consultation pursuant to section 7 of the Endangered Species Act of 1973, as amended (Act), on the Bureau of Reclamation's (Reclamation) continuing long term operation of the Klamath Project (Project). We received your Biological Assessment on February 28, 1992. At issue are the effects of proposed long term operations of the Project on two federally listed endangered fishes, the Lost River sucker (*Deltistes luxatus*) and shortnose sucker (*Chasmistes*

brevirostris), and the bald eagle (*Haliaeetus leucocephalus*). The bald eagle is listed as federally endangered in California and threatened in Oregon. Although the area affected by Project operations is within the range of the American peregrine falcon (*Falco peregrinus anatum*), this species likely will not be affected by the Project proposal. Thus, the American peregrine falcon will not be addressed in this consultation.

Provision of water pursuant to the operations of the Klamath Project affects the endangered species resources both within and outside the Project service area. In the case of Project operations, the effects of the action extend to those areas where water is actually delivered (the Project service area) and to all other areas directly or indirectly affected by Project water delivery. The effects of long-term Project operation also extend to areas affected by reductions in Klamath River water as a result of the operation of Project facilities. Areas affected by reductions of Klamath River outflow include the Link River, Lake Ewauna, Lower Klamath Lake, irrigation operations that divert water from the Klamath River, and the Klamath River downstream of Lake Ewauna.

The direct, indirect, interrelated, and interdependent effects of the action, and cumulative effects, are added to the environmental baseline that is evaluated together with the current status of the species or critical habitat to ascertain the likelihood of a given action jeopardizing the continued existence of the listed species or adversely modifying or destroying critical habitat under consideration. The environmental baseline includes the past and present effects of all Federal, State, or private actions and other human activities in the action area, the anticipated

effects of Federal actions that have undergone formal or early Section 7 consultation, and the impact of State and private activities that are contemporaneous with the consultation process. In examining the current status of a listed species, the Service considers the species' needs, including its breeding, feeding, and sheltering requirements.

This biological opinion is based on (1) information presented in Reclamation's Biological Assessment, dated February 28, 1992 (USBR 1992), and its appendices; (2) Information presented in all previously released biological opinions dealing with aspects of the operation of the Project; (3) Information collected from Reclamation in meetings and telephone conversation on aspects of the operation of the Project, or on current results of field research activities; (4) Information provided by various published and unpublished reports on the biology, distribution, systematics, and status of species and their ecosystems found in the Project area; (5) Communications with field researchers who have conducted, or are now conducting, research on the biology of the species found in the Project area, or their ecosystems.

Biological Opinion

It is our biological opinion that the long-term operation of the Klamath Project as described under the *Description of the Proposed Action*, is likely to jeopardize the continued existence of the Lost River and shortnose suckers. It is our biological opinion that the proposed Project operation is not likely to jeopardize the continued existence of

the bald eagle. Critical habitat has not been designated for any of these three species.

Description of the Proposed Action

The proposed action, the long-term operation of the Project, combined with the mitigation measures to be included in the action is described in the February 28, 1992, biological assessment for this project and is hereby incorporated by reference.

Conservation Actions:

At a meeting on 4 June 1992 between Reclamation and Service personnel, the Klamath Project Office agreed to include the following mitigation measures in their "Description of Action". By including these actions, Reclamation demonstrates a commitment to the survival and recovery of the endangered species that exist in the Project area. These mitigation measures were originally described in the Biological Assessment as "Possible Mitigation Measures", or were developed with the assistance of the Service as actions likely to enhance survival and recovery of listed species. Data collected during these studies may be used as a basis for re-initiation of consultation.

Mitigation Measures Included in the Action:

1) Sucker Toxicity Studies

Bioassay work on both larval and juvenile suckers is essential information for the decision making process. By

determining lethal tolerances for dissolved oxygen, temperature, ammonia, pH, and algal toxins singly and combined, the ability to assess habitat availability (based on water quality) will be gained. This information will have many uses such as: when and where to release hatchery fish, setting goals for water quality management, etc. Reclamation has contracted with the USFWS Research Station, Dixon, California, to do this work in 1992.

2) Life History, Population Dynamics, and Environmental Factors Affecting the Suckers

This study would provide for the continuation of current research that will culminate in recovery and management recommendations for Lost River and shortnose suckers in the Lost River watershed and the Klamath River system down to Iron Gate Dam by 1996. Reclamation will participate and cost share in (a) continue distribution surveys, life history, and population studies begun in Clear Lake in 1989; (b) extend distribution surveys to include the entire Lost River system (i.e., into Oregon) and the Klamath River system downstream to Iron Gate Dam; (c) describe seasonal distribution and habitat use by different life stages; and (d) define preferred habitat for major life stages and their correlation with water quality, depth, and flow. Items a through d will be coordinated among the California Department of Fish and Game (CDFG), Oregon Department of Fish and Wildlife (ODFW), and the Seattle National Fisheries Research Laboratory, Reno Office.

3) Assess External Nutrient Loading to Upper Klamath Lake

The overall objective is to assess sources of external nutrient loading to the lake and the role reservoir regulation has had on flushing patterns in the lake. The other major emphasis of the work will be to assess nutrient flux to the lake from shallow ground water.

Nutrient loading to the lake from small streams, ditches, and canals is currently being assessed by Reclamation and the Klamath Tribe. The U.S. Geological Survey was just contracted by the Project Office to complete a 5 year study to determine loading from the major streams, determine the ground water component, compile input from Reclamation and the Klamath Tribe, and investigate the role of reservoir regulation in nutrient dynamics.

4) Compilation and Analysis of Past Water Quality Investigations in the Klamath Basin

Through the years many studies have been conducted in connection with water quality in the Basin. To date no comprehensive compilation or analysis of these data has been done. Investigation into the data collected by these studies may provide fruitful (and relatively inexpensive) insight. Further, these data will provide a valuable baseline for ecosystem recovery efforts by allowing comprehensive modeling of the basin and drainage system, water and nutrient inputs, and of water use demands. Reclamation will assist in the efforts.

5) Taxonomy of Klamath Basin Suckers

A critical need in any recovery program for the Klamath Basin suckers is the ability to identify individual fish at

all life history stages and know the taxonomic status of the sucker species. A combination of morphological and molecular approaches to this problem is most likely to produce useful results. A full-time effort by a molecular systematist and a morphological systematist is necessary to build from the current uncertain knowledge base and resolve the specimen identification problem. Reclamation is currently funding Oregon State University to perform much of this work. The CDFG has contracted the University of California, Los Angeles, to complete some as well.

6) Monitor Spawning Usage at Springs

In 1991 Reclamation placed gravel in several discrete areas with a mixture of larger rock in an attempt to more closely matches preferred spawning substrate sizes reported by Buettner and Scoppettone (1990) and observed by Tribal biologists. Sucker Springs now has a variety of substrate sizes available for spawning suckers to select among. Reclamation, in cooperation with the Klamath Tribe, will monitor Sucker Springs and other spring areas to assess relative intensity of use and relative habitat quality among the different substrate types. This will refine our understanding of the spawning substrate and habitat needs of these fish which should allow future enhancement work to be based on hard data which should result in more effective habitat improvement. Reclamation will conduct and/or assist the Klamath Tribe in conducting ongoing monitoring studies to determine at what water depth, size of gravel substrate, water temperature, pH, and dissolved oxygen concentrations lake-spawning populations of Lost River and shortnose suckers spawn and emerge. Current spawning material at Sucker Springs is placed relatively high with respect to

lake levels. The placement of additional material at lower levels may provide spawning opportunities in the event of lower water levels, but increasing water levels during the spawning and incubation period could reduce the viability of eggs buried in the gravels at lower levels. Reclamation intends to place gravels at lower elevations this fall and monitor sucker use and egg viability. The Project will investigate other options to improve spawning conditions at Sucker Springs to provide favorable conditions at various lake elevations. These studies will include the 1993 spawning season and continue until the recovery team determines that the needed information has been obtained. Reclamation will use this information to improve spawning habitat at Sucker Springs and other springs where these fish spawn.

7) Locate Springs in Upper Klamath Lake and Enhance the Substrate Conditions to Create Sucker Spawning Habitat

Large springs are known to be present in Upper Klamath Lake. Locating the springs and evaluating their suitability for sucker spawning to determine if adding sufficient quantities of suitable gravels over the springs could create suitable sucker spawning habitat will be coordinated with the Klamath Tribe and ODFW. This work would be completed by March of 1994.

8) Spawning Enhancement in the Vicinity of Barkley Springs (Upper Klamath Lake)

Historically Barkley Springs was the site of prolific spawning activity. Thirty years ago Hagelstein Park was developed by Klamath County in the immediate vicinity of the springs. Construction of the park included diking,

ponding and the rerouting of water. This caused spawning to essentially cease, although it has been reported that as late as 1973 great numbers of suckers attempted to reach this traditional spawning ground.

This project would include the compilation of baseline usage data, replacement of gravel, land surveys, hydraulic design, construction of passage facilities and subsequent monitoring of use. Klamath County is very supportive of any enhancement work and would be willing to assist. The site is also the source of water for one irrigator and any work may need to include alterations of pumping and/or diversion facilities to allow for meeting both needs. This work would be completed in time for the sucker spawning runs in March of 1993.

9) Assess Methods to Improve Passage in the Sprague River.

The construction of the Sprague River dam near Chiloquin effectively blocked approximately 95% (70 river miles) of the potential spawning range of the Lost River and shortnose suckers in Upper Klamath Lake. The dam was constructed in 1914-1918 by the Klamath Agency with assistance from the Bureau of Indian Affairs. The dam provides water diversion for 5300 acres of irrigable land in the Modoc Point Irrigation District.

The Nature Conservancy has completed a study for the Service to determine the cost and feasibility of alternative strategies that would provide fish passage for suckers around the dam. Reclamation proposes to further examine the issue, to the extent of developing engineering plans for various alternatives. These plans will help to further assess the costs of such a project, determine which

alternative will have the greatest chance of providing the passage the fish need and methods for implementing that alternative. If a feasible plan is determined before March, 1993, Reclamation will attempt to implement it before spawning in 1993.

10) Assess Marsh Restoration

Reclamation will participate in experimental pilot projects within three to five years to assess the potential for restoring marshlands around Upper Klamath Lake and to determine if this will improve water quality, sucker habitat, and/or survival. These actions will be coordinated with the Service, the Tribe, and ODFW.

11) Determine Prey Species and Foraging Distribution of Bald Eagles at Gerber Reservoir, Due to Drought Stresses.

Because of competition due to reduced foraging area or if reservoir levels remain at minimum pool, one of the two nesting pairs may be forced out of Gerber Reservoir and may forage at a nearby reservoir. During the nesting season nearby reservoirs, such as Upper Midway, Round Valley, Dog Hollow, and others, could be monitored for eagles foraging and bringing prey back to nests at Gerber. If it was found that limited forage was affecting reproductive efforts, a supplemental feeding program could be initiated for the nesting eagles. Reclamation has contracted the Bureau of Land Management (BLM) to accomplish this work and monitoring is in progress.

12) Support the USFWS Ecosystem Recovery for Klamath Basin

Reclamation will assist the Service in the development and implementation of workshops or symposia to educate the public, water users, agency personnel, and other interested parties in the nature of Klamath ecosystem problems, symptoms, solutions, and recovery. These workshops will be invaluable for establishing public involvement in the recovery process, and will provide a forum for the gathering of meaningful data by the recovery team and the Service.

13) Investigate a New Channel at the Mouth of Willow Creek into Clear Lake

Concern has been expressed by the U.S. Fish and Wildlife Service that during periods of low water levels in Clear Lake, suckers emigrating from Willow Creek likely follow the existing channel out of Willow Creek down toward the dam where they may entrained through the dam. Reclamation will investigate moving the mouth of Willow Creek further south into the more central part of the east lobe of the lake to avoid this potential hazard. Reclamation will also investigate the lake elevation required for spawning access and larval dispersal from Willow Creek.

14) Genetic Relationships

Management of the endangered Lost River and shortnose suckers has been complicated by the suggestion that variable morphological characteristics in both species may be the result of hybridization and introgression among these and two other Klamath Basin suckers, the largescale and

smallscale sucker. Within 2 years of issuance of this biological opinion, Reclamation will assist the Service, ODFW, CDFG, and the Klamath Tribe, in designing a comprehensive taxonomic study and contribute financial support for it. This study is designed to determine the genetic relationship among four Klamath Basin sucker species, differences within the endangered species, and whether or not these species are presently hybridizing or may have hybridized in the past. This information could be used to improve management of the different populations of endangered suckers and is essential for any future hatchery operations.

15) Watershed Improvement

Within 2 years of issuance of this biological opinion, Reclamation will develop and begin to implement a long-term plan to restore riparian areas along Upper Klamath Lake tributaries and marshland habitat adjacent to Upper Klamath Lake with a goal of improved water quality conditions, water storage capacity, and habitat for all life stages of endangered suckers in Upper Klamath Lake. The long-term plan will be developed in cooperation with the Service, Soil Conservation Service, ODFW, the Klamath Basin Steering Committee, Klamath County, the Klamath Tribe, and other agencies with statutory responsibilities for protection of State and federally listed endangered species and improving water quality. The plan will establish water quality goals, an implementation time schedule, and a budgeting strategy that will assure adequate funding to share costs of securing and protecting marshland and riparian habitat through willing-seller acquisition, conservation easement or other options. Critical areas could be secured in the initial

implementations and a total acreage goal established after needed information is received from pilot projects and other research. Full implementation of this plan will be reviewed at 5 year intervals to determine status of implementation based upon existing information.

16) Internal Nutrient Loading

Within three to five years of issuance of this biological opinion, Reclamation will participate in developing, conducting, and providing technical and financial support for a study of internal nutrient loading in Upper Klamath Lake to help identify possible solutions to the lake's water quality problems and provide information for a complete nutrient budget. This information will be used to identify and implement where possible measures to reduce total nutrient loading.

17) Recruitment Study

Recruitment failure in Lost River and shortnose suckers in Upper Klamath Lake appears most severe between larval and adult life stages. Reclamation will lead an investigation of the interrelationships of lake level, juvenile sucker habitat (including emergent marsh), and recruitment success. It is anticipated that the results of this study will provide information on the observed or potential response of sucker populations to lake level fluctuations and may be used in later refinement of lake level management practices.

18) Investigate the Feasibility of New Storage

Reclamation, working jointly with the Service, will develop a feasibility study to investigate reducing evaporation and/or increasing storage in the Lost River

system for the purposes of increasing water supplies for: 1) Refuges, 2) downstream water needs, 3) endangered suckers, 4) more stable irrigation supplies, 5) other wildlife resources.

19) Monitor Refugial Areas

Reclamation will study potential refugial areas (including Pelican Bay, Williamson River, Wood River and other sites as they are identified) in Upper Klamath Lake to determine the extent and conditions of sucker utilization of these habitats. Water quality will be monitored in and around these refugial areas to determine the suitability of these refuge sites. This study will begin during the summer of 1992 to determine the availability and suitability of refugial areas during low water conditions.

20) Re-evaluate the Flood Plan

Reclamation is in the process of re-evaluating the flood plan and flood capacity of Tule Lake and will use this information to evaluate the safety of the operations outlined in the reasonable and prudent alternatives described below for Tule Lake. If the results of this study indicate a safety concern, consultation will be re-initiated.

Species Accounts/Environmental Baseline

The following section provides information on the current status of the listed species addressed in this biological opinion and anticipated trends in habitat availability. The information presented in this section is the basis against which the effects of the action are measured over the life of the action.

This section of the biological opinion was prepared with information from the following sources: 1) Reclamation's February 28, 1992 Biological Assessment on Long-Term Operations of the Klamath Project; 2) The Service's August 14, 1991 Biological Opinion on the Effects of the 1991 Operation of the Klamath Project on the Lost River sucker, the shortnose sucker, Bald Eagle, and American Peregrine Falcon; 3) Communications with field researchers who have conducted, or are currently conducting, research on the listed suckers; 4) Communications with Reclamation personnel and applicants. It should be noted that some of the personal communications cited occurred between the authors of the Project Biological Assessment and the researcher. In citing these communications, the Service may not have been able to further verify the information discussed.

Species Accounts:

Bald Eagle

The bald eagle is a generalized predator/scavenger primarily adapted to edges of aquatic habitats. Its primary foods, in descending order of importance, are fish (taken both alive and as carrion), waterfowl, mammalian carrion, small birds, and mammals. The species is long-lived, and individuals do not reach sexual maturity until 4 or 5 years of age. Further general description of the species' biology may be found in Palmer (1988).

The bald eagle once nested throughout much of North America near coasts, rivers, lakes, and wetlands. The species suffered population declines throughout most of its range, including Oregon and California, due primarily

to habitat loss, shooting, and environmental pollution (Snow 1973, Detrich 1986, U.S. Fish and Wildlife Service 1986, Stalmaster 1987). The drastic decline of this species led to its listing for protection under the Act on February 14, 1978 (Federal Register 43: 6230-6233). The species is listed as endangered in 43 states, including California, and as threatened in 5 states, including Oregon. Bald eagles are sensitive to human disturbances such as recreational activities, homesites, campgrounds, mines, and timber harvest near roosting, foraging, and nesting areas (Thelander 1973, Stalmaster and Newman 1976, U.S. Fish and Wildlife Service 1986).

In recent years, the status of bald eagle populations has improved throughout the United States. In 1990, the Service published an advance notice of a proposed rule (Federal Register 55:4209-4212) which would reclassify the species from endangered to threatened throughout the lower 48 states. The Pacific Region Bald Eagle Recovery Team has found that reclassifying the species as threatened is justified in the 7 northwestern States (California, Oregon, Washington, Idaho, Montana, Wyoming, and Nevada) comprising the Pacific Recovery Region (Steenhof 1990). The Klamath Basin is one of 45 Recovery Zones in this Recovery Region.

Bald eagle populations in the Klamath Basin include 3 groups: breeding adult pairs, nonbreeding immature and subadults, and migratory adults which breed in other areas. Following is a brief discussion of the biology and status of each of these groups.

In 1990, the Klamath Basin Recovery Zone contained 79 occupied breeding sites, nearly equalling the Bald Eagle

Recovery Plan (Recovery Plan) population goal of 80 for the zone (Steenhof 1990). Mean reproduction among this population over the past 5 years has been 0.93 young per occupied site (Isaacs and Anthony 1990), which is near the standard of 1.0 set by the Recovery Plan. Adult bald eagle pairs begin egg-laying between early March and mid-April; eggs are incubated for 5 weeks before hatching. Eaglets remain on the nest for 10 to 12 weeks before their first flight. Bald eagle nesting pairs which may be affected by the project include 2 pairs at Gerber Reservoir and over 30 pairs at Upper Klamath Lake.

The Klamath Basin is known to provide summer habitat for nonbreeders from other zones (Jackman pers. comm.), and large numbers of nonbreeders and adults from throughout the Pacific Northwest migrate into the Basin during the late fall and winter months. Winter counts during the 1980's have ranged from 500 to 1000 eagles (Opp pers. comm.), making this one of the most important wintering areas in the continental United States. The primary prey base for wintering eagles in the Klamath Basin is waterfowl and small mammals (Frenzel 1984). Areas used for foraging include both privately-owned agricultural lands and State and Federal wildlife refuges.

The prolonged presence of predator/scavengers such as bald eagles in the project area is an indication of a relatively consistent availability of prey. In addition to influencing presence of eagles, prey availability also influences eagle reproductive rates, because the prebreeding condition of a female raptor determines its ability to produce eggs (Newton 1979), and because food must be available not only for the adults but for their

young. Thus, bald eagles must obtain enough food during the winter to come into breeding condition in early spring, support 5 weeks of incubation, and provide food for nestlings and fledglings for about 4 months. Lack of food at various points in the breeding cycle may inhibit nesting attempts, cause abandonment of the nesting effort, or result in starvation of young. Bowerman (1986) documented low bald eagle reproduction in years following removal of rough fish by rotenone treatments in northern Michigan, and a similar result was observed in years following rotenone treatment of a northern California reservoir. In 1990, ospreys (which are also piscivorous) abandoned young at Oregon's Hyatt Reservior, where rotenone treatment had dramatically reduced prey abundance and availability.

Reproductive rates are also subject to several secondary variables, including weather, contaminants, and disturbance factors. Because bald eagles evolved in the climate of the Pacific Northwest, weather is believed rarely to be a serious factor. Serious storms that occur at the time of incubation or hatching create an exception. Low productivity in the Klamath Basin in 1982 was believed to be the result of such storms (Frenzel 1984). While several persistent contaminants have been documented in eagle tissues in the project area, Frenzel (1984) concluded that contaminant levels had no significant effect on the area's bald eagle reproduction in the early 1980's. Human disturbance may be a factor at certain sites, but is not believed to be pervasive in the project area. None of these factors appear to impose serious limits on eagle populations at the present time.

In the absence of the above secondary effects, prey availability is believed to be the primary limiting factor for these eagle populations. Prey becomes available to bald eagles in two ways: (1) when the behavior of a live individual prey item makes it available for capture, such as a fish basking or feeding near the water surface; or (2) when the carcass of a dead individual is available on the ground, on ice, in shallow water, or floating at the water surface. Only a portion of available prey is actually discovered and taken before it becomes unavailable. The number of available prey items is, therefore, a function of prey population size, expressed through prey behavior and mortality rates.

In the Klamath Basin, there are three major classes of prey: (1) fish, breeding waterfowl, and small mammals available during the eagle breeding season; (2) concentrations of migratory waterfowl available to eagles during the fall and winter months; and (3) small mammals made available due to irrigation flooding during late winter months. Each of these forage classes is influenced by water management.

At Upper Klamath lake, important prey species during the eagle nesting season include tui chub (Gila bicolor), blue chub (G. coerulea) and suckers (Frenzel 1984). Species composition of eagle prey at Gerber Reservoir has not been documented. The reservoir's fishery resource consists largely of introduced species such as crappie, perch, bass, and also includes rainbow trout and native suckers.

Irrigation deliveries throughout the system eventually reach the National Wildlife Refuges and direct water

deliveries are made form Upper Klamath Lake and the Klamath River to the Refuges, providing habitat for hundreds of thousands of migratory waterfowl. These waterfowl provide the primary prey base for the hundreds of migratory eagles which visit the Basin during the winter months.

Lost river and Shortnose Sucker

Surveys carried out in the Klamath Basin prior to and after the construction of Reclamation's Klamath Project and Link River Dam indicated that sucker populations were very large. Cope (1879) described the Lost River sucker and shortnose sucker from specimens he had gathered from Upper Klamath lake. Both species are endemic to the Klamath Basin. Cope (1884) later noted that Upper Klamath Lake sustained "a great population of fishes" and was "more prolific in animal life" than any body of water known to him at that time. Gilbert (1898) noted that the Lost River sucker was "the most important food-fish of the Klamath Lake region." At that time, spring sucker runs "in incredible numbers" (Gilbert 1898) were relied upon as a food source by the Klamath and Modoc Indians and were taken by local settlers for both human consumption and livestock feed (Cope 1879, Coots 1965, Howe 1968). Sucker runs were so numerous, in fact, that a cannery was established on the Lost River (Howe 1968) and several other commercial operations processed "enormous amounts" of suckers into oil, dried fish, and other products (Andreasen 1975). Even through the 1960's and 1970's, runs of suckers up the Williamson and Sprague Rivers were great enough to support a popular sport fishery (Fortune per. comm.). The first concerns

were expressed over declining sucker populations in the 1960's (Vincent 1968, Golden 1969). Surveys conducted in 1984-1986 indicated a major decline in Lost River and shortnose sucker populations (Bienz and Ziller 1987) and the fishery was closed in 1987. Both Lost River and shortnose suckers were federally listed as endangered species on July 18, 1988 (Federal Register 53:27130-27134). Because the Lost River sucker is the only species in the genus *Deltistes*, this entire genus is endangered as well.

Reclamation's biological assessment describes in detail the taxonomy and identification of Lost River and shortnose suckers (USBR 1992).

Over 100,000 of the 240,000 project irrigated acres were marshlands prior to project actions. The conversion of these wetlands to agriculture has reduced the amount and presumably the quality of habitat available to the suckers. Project and non-project irrigation has decreased inflows into the lakes and rivers and increased nutrient loading from return flows, which has contributed to the hypereutrophic condition of most of the water in the Upper Klamath Basin (USGS 1991).

Distribution

Lost River sucker

The Lost River sucker is native to Upper Klamath Lake (Williams et al. 1985) and most of its tributaries, including the Williamson, Sprague, and Wood rivers, Crooked Creek, Seven Mile Creek, Four Mile Creek, Odessa Creek, and Crystal Creek (Stine 1982). It is also native to the Lost

river system, Lower Klamath Lake, Sheepy Lake (Williams et al. 1985), and Tule Lake (Stine 1982). The present distribution of Lost River suckers includes Upper Klamath Lake and its tributaries (Buettner and Scoppettone 1990), Clear Lake Reservoir and its tributaries (Buettner pers. comm.), Upper Klamath River downstream to Copco Reservoir (Coots 1965, Beak 1987) and Tule Lake (Scoppettone, pers. comm.). A few individual Lost River suckers were observed spawning in the Lost River below the Anderson Rose Dam in 1991, and it is presumed that these individuals migrated from Tule Lake, where 20 adults and one juvenile have been captured this year (Scoppettone pers. comm.). Larval Lost River suckers were collected in the Wood River and Crooked Creek in 1991 (Logan pers. comm.) which indicates a spawning run still occurs these streams. Suckers have been reported from Sheepy lake in 1988 and may represent a resident population but positive species identifications were not made (Johnson pers. comm.).

Shortnose sucker

The historic distribution of the shortnose sucker is Upper Klamath Lake and its tributaries (Miller and Smith 1981; Williams et al. 1985), Lake of the Woods (Moyle 1976), and possibly the Lost River drainage. Shortnose suckers now inhabit the same waters as the Lost River Suckers and additional sites, including the Lost River, and Gerber Reservoir. Shortnose suckers have also been collected on the Upper Klamath River from Copco Reservoir to the Link River Dam. Shortnose suckers found in Gerber Reservoir and Clear Lake show some morphological differences from those found in Upper Klamath Lake and

Copco Reservoir (Buettner pers. comm). Starch gel enzyme electrophoresis revealed differences between the shortnose sucker populations in Clear Lake and Upper Klamath Lake (Moyle and Berg 1991). Their presence in the Lost River is well documented and spawning has been observed in Bonanza Springs in the past and in 1992 (Buettner pers. comm.), although at least one researcher has stated that it is unlikely that a viable population exists within the river (Stine 1982). Shortnose suckers were observed spawning below Anderson Rose Dam in 1991, and it is presumed that these individuals migrated from Tule Lake, where 18 adults were captured this year (Scoppettone pers. comm.).

Little is known about the endangered sucker population inhabiting Gerber Reservoir. In May of 1992, Over 200 shortnose suckers were collected ranging in size between 78 and 461 mm FL. This indicates that the population of shortnose suckers in Gerber reservoir have successfully spawned in the last few years (Buettner pers. comm). Juvenile suckers (less than 100 mm) were observed in Barnes Valley Creek in 1992, indicating successful reproduction in the creek in 1991 (Buettner, pers. comm.).

Reason for Decline

Lost River and shortnose suckers

Not all of the factors responsible for the decline of these species are clear, but they are thought to include the damming of rivers, dredging and draining of marshes, instream flow diversions, over-harvest, introductions of non-native fish, and a shift toward hypereutrophication and poor water quality in Upper Klamath Lake and

waters downstream. These factors may affect populations in different waterbodies to different degrees. Some of these conditions are difficult to control or reverse. A recent analysis of the population genetics of the Lost River sucker and shortnose suckers (Moyle and Berg 1991) suggested that "if populations continue to decline, these species may cross below the minimum viable population threshold and be lost." Entire stocks may have already been lost [e.g., Harriman Springs, Barkley Springs (Andreasen 1975, Bond pers. comm., Buettner pers. comm.)]. The largest remaining populations of Lost River and shortnose suckers are believed to occur in Upper Klamath Lake and Clear Lake (Scoppettone pers. comm.).

Age and Growth

Lost River suckers

Scoppettone (1988) aged Lost River suckers from Upper Klamath Lake up to 43 years old. Lost River suckers are one of the largest sucker species and may obtain a length of up to 1 meter in total length (Moyle 1976). Sexual maturity for suckers sampled in Upper Klamath Lake occurs between the ages of 6 to 14 years, with most maturing at age 9, with most growth in Upper Klamath Lake occurring mainly during the first 8 to 10 years of life (Buettner and Scoppettone 1990).

Shortnose suckers

Scoppettone (1988) found shortnose suckers up to 33 years of age from Copco Reservoir. Sexual maturity for

shortnose suckers appears to occur between the ages of 5 and 8 with most maturing at the age of 6 or 7 (Buettner and Scoppettone 1990). Buettner and Scoppettone (1990) found that for female shortnose suckers sampled from Upper Klamath Lake, most growth occurred in the first 6 to 8 years of life.

Reproduction

Lost River and shortnose suckers are lake suckers that generally spawn in rivers or streams and then return to the lake. However, both species have separate populations that spawn near springs in Upper Klamath Lake (Scoppettone pers. comm.). More detailed spawning information for both sucker species is given in the biological assessment (USBR 1992).

Upper Klamath Lake Endangered Sucker Populations

In Upper Klamath Lake, recruitment of the Lost River and shortnose suckers to adult size classes has become inconsistent, as evidenced by gaps in known year classes of spawning adults. The last known strong year classes are from 1977 and 1978 (Buettner and Scoppettone 1990). A juvenile year class from spawning activity in 1991 may represent a future year class (Markle pers. comm), but because it is not known if most mortalities in any one year class occur in the larval, juvenile, or young adult stages, it is impossible to know if this year class will survive to maturity.

A distinct population of Lost River suckers normally spawns at Sucker Springs from mid-March through mid-

April, but may begin as early as the first of February (Andreasen 1975, Buettner and Scoppettone 1990, Klamath Tribe 19910. The entire existing gravel bed where spawning occurs at Sucker Springs is not covered with water until lake surface elevation rises above 4,141.5 feet. However, less than half of the gravel is usable spawning habitat at this level (Klamath Tribe 1991). Reclamation plans to expand the existing gravel bed to allow spawning at lower lake level elevations. Buettner and Scoppettone (1990) observed Lost River suckers spawning at Sucker Springs in water depths of 18 centimeters (cm) to 61 cm (0.6 to 2.0 feet). Therefore, a lake level of 4,141.0 feet from March through April would provide access to the gravel suitable for spawning habitat. The substrate type most available to suckers that spawn in the lake is similar to rip-rap type material (Scoppettone pers. comm.) which makes eggs vulnerable to predation due to their inability to adequately cover the eggs completely when spawning. A rainbow trout captured at Sucker Springs during sucker spawning was documented to have a stomach full of eggs that were the same size and color of Lost River sucker eggs (Andreasen 1975). Spawning gravel was added to Sucker Springs in 1987 and large numbers of Lost River suckers were observed using the improved area (Buettner pers. comm.). Suckers spawning at Sucker Springs were observed burying their eggs down into the gravel (Scoppettone pers. comm.) which would minimize or eliminate predation on the eggs by other fish. The depths that fish were observed spawning at were 18 cm to 61 cm (Buettner and Scoppettone 1990). A lake level of approximately 4,142.1 feet was suggested by the Service in the August 14, 1992, biological opinion, as a

lower limit for sucker spawning at Sucker Springs. However, observations at Sucker Springs in 1992 indicate that stability of water levels during the spawning period may be more important than the level itself. It is theorized that increases in lake levels allow colder lake water to displace the warmer spring water the eggs were laid in, thus reducing survival of the eggs (Dunsmoor pers. comm.). Therefore a maximum increase in surface elevation of one foot during the spawning and incubation and minimal increases during the early incubation period is recommended to maintain more suitable habitat. This opinion sets more historic and stable lake elevations for spawning at Sucker Springs.

There was also a population of Lost River suckers that historically spawned at Barkley Springs, which was incorporated into Klamath County's Hagelstein Park in the early 1960's. Access to the spring and its spawning gravels is now currently blocked by a dam that forms a pond, although suckers attempted to spawn in the area as recently as 1973 (USBR 1992). Spawning access could be re-established by modifying the outflow of the pool.

Shortnose sucker spawning activity was observed at Ouxy Spring in Upper Klamath Lake on April 30, 1992 (Dunsmoor pers. comm.). The lake surface elevation at the time was reported by Reclamation to be 4141.68 feet. It is not known if this population is restricted to spawning in this spring area.

Most of the Lost River and shortnose suckers that spawn in the tributaries of the lake do so in the Williamson River and Sprague River downstream from the Chiloquin Dam, although the presence of larvae and juvenile Lost River

suckers in the Wood River and Crooked Creek may indicate the presence of an unstudied spawning run (Logan per. comm.). Historically, suckers also spawned in Seven Mile Creek, Four Mile Creek, Odessa Creek, and Crystal Creek and some suckers may still these streams, but their status is unknown. Few of either sucker species have been observed passing the fish ladder at Chiloquin Dam (Bienz and Ziller 1987; Buettner and Scoppettone 1990). Potential spawning habitat exists in 50 km of the Sprague River; of which 48 km is upstream from the Chiloquin Dam (Buettner and Scoppettone 1990). The shortnose sucker is also thought to have used the river upstream from the dam, but documentation of the extent is lacking (Buettner and Scoppettone 1990; Dunsmoor, pers. comm.). Current stream habitat conditions in both the upper Williamson and Sprague River drainages may preclude successful spawning, if access were established, but spawning habitat could be improved. Removal or alteration of the dam to allow fish passage would enlarge the potential spawning habitat by at least a factor of fifty, which may be more efficient and cost-effective than any hatchery program (Scoppettone and Vinyard 1991). The amount of current spawning habitat available may not be limiting the sucker populations, but the concentrations of spawning suckers in relatively small areas of suitable habitat may increase the likelihood of hybridization between species (Scoppettone per. comm.).

For steam spawning populations, shortnose and Lost River suckers begin their spawning migration into the Williamson and Sprague Rivers in late March or early April, with spawning activity often continuing well into May (Andreasen 1975, Buettner and Scoppettone 1990).

Larval sucker migration from the spawning sites on the Sprague and Williamson Rivers can begin in May or June. Bienz and Ziller (1987) reported that larval sucker emigration surveys were initiated in May of both 1983 and 1984, but no suckers were sampled until mid June of both years. Buettner and Scoppettone (1990) found that over 90 percent of Lost River sucker juveniles emigrated back to Upper Klamath Lake between 5 May and 15 June in both 1987 and 1988. They found that the majority of shortnose sucker juveniles emigrated within a six-week period after 1 May and 7 May in 1987 and 1988, respectively. It appears that most larval emigration for both species occurs between the hours of 2000 and 0700 (Coleman and McGie 1988; Buettner and Scoppettone 1990). During the day, the larvae typically move to shallow shoreline areas in the river (Dunsmoor pers. comm.). The channelization of the lower Williamson River may have negatively affected sucker survival by reducing larval rearing and refuge habitat (Dunsmoor, pers. comm.). Higher densities of larval suckers seem to occur in "pockets of open water surrounded by emergent vegetation" and possibly use the leeward side of this vegetation as a refugium from wave action (Klamath Tribe 1991). Larval and juvenile suckers were found by Buettner and Scoppettone (1990) to occur in greatest frequency at 41-50 cm depth (1.35-1.64 feet). Along the lower margins of the Williamson, Buettner found that 35 percent of the larvae were found at sites with emergent vegetation. After emigrating from the parental spawning sites in late spring, larval and juvenile Lost River and shortnose suckers inhabit near shore waters, primarily under 50 cm (19.7 inches) in depth, throughout the summer months

(Buettner and Scoppettone 1990). Juvenile suckers were found along gentle slopes and were bottom oriented over sand and mud, both in areas devoid of cover and next to macrophytes (Buettner and Scoppettone 1990). In surveys conducted by Oregon State University between July 18 and October 17 of 1991, juvenile suckers were found distributed in near shore areas throughout the lake in beach seine, and case net surveys during the summer. Trawling collected suckers in more open water habitat in October (Markle 1992). The importance of vegetative cover is unknown and sampling in these areas is difficult and limited, but larval and juvenile suckers are known to use these areas and studies to determine habitat preference and survival rates for larval and juvenile suckers are being conducted by Reclamation. Little is known about the life history traits of the Lost River and shortnose suckers during the winter months.

Entrainment of larval suckers has been documented at the A Canal headworks (Markle 1992). In 1991, entrainment estimates peaked twice, once in early June (at 43,887 suckers per day) and once in early July (at 21,773 suckers per day). All but one of the suckers collected during the June peak were identified as Lost River suckers (Markle per. comm.). The suckers collected during the July peak were shortnose and Klamath largescale suckers and preliminary identifications indicate that most of these fish are shortnose suckers (Markle per. comm.). The cumulative estimate for the period between May 13 and July 15 was 759,150 larval suckers entrained. The cumulative estimate was extrapolated from a total catch of 51 larval suckers and 35 of the 51 suckers have been identified as Lost River suckers (Markle 1992). The 3,236 suckers of

undetermined species salvaged out of the Project canals in October-December of 1991, provides further evidence of entrainment.

Upper Klamath Lake was historically eutrophic, but has become hypereutrophic. It has been hypothesized that the hypereutrophic condition of the lake is a result of 20th century marsh drainage and agricultural practices within its watershed (Miller and Tash 1967, Vincent 1968). More than 30,000 acres of marsh around Upper Klamath Lake have been lost this century. Other proposed reasons include changes in the timing and rate of lake flushing due to both dam regulation and changes in inflow, decreases in lake level due to dam regulation and irrigation releases causing the lake to be warmer and more conducive for algal production, and to increased nutrient concentrations due to decreased lake volume. Project actions are not responsible for all of these changes, but would be a contributing factor in most of the proposed reasons for the hypereutrophic condition of Upper Klamath Lake.

Project actions have changed the timing and magnitude of lake level fluctuations. The historic hydrograph for Upper Klamath Lake was flatter, peaked earlier (March/April) than it does under current water management practices (USBR unpubl. data), and had an "average natural fluctuation of the water surface of 2 feet" (Boyle 1976). The pre-project maximum fluctuation was only 2.3 feet, albeit for a short period of record. Annual project induced fluctuations average about three feet, although fluctuations can exceed 5 feet.

Lake nutrient inputs and cycling have been altered, and it has been hypothesized that, as a result, the algal community has shifted to more of a monoculture of the blue-green alga *Aphanizomenon flos-aquae* which is more efficient than green algae at utilizing low concentrations of carbon dioxide. The massive blooms of algae that occur during the summer and autumn months are known to cause extremely high pH, wide fluctuations of dissolved oxygen and carbon dioxide levels, a green appearance and foul odors as the algae decay, and possibly an algal toxicity problem. Fish kills in 1971 and 1986 are through to have been caused by water quality problems associated with the algae, such as dissolved oxygen depletion due to high water temperatures, and extensive algal decay.

The role of internal nutrient loading is uncertain. Studies by Sanville et al. (1974) showed concentrations of nitrogen and phosphorus in the interstitial water of Howard Bay sediment were several times higher than those near Buck Island and the lake outlet and was believed to be the result of agricultural drainage from nearby ranches. A sediment core taken near the outlet of the lake indicated an accelerated rate of sedimentation in more recent years, possibly related to changes in the watershed and productivity of the lake (Sanville et al. 1974). Miller and Tash (1967) stated "the quantity of nitrogen and phosphorus in only the upper one inch of lake sediments is as great as that quantity which would flow into the lake during the next 60 years if the present rate of inflow continues." However, the availability of sediment nutrients is unknown. Available nutrients may not be unlimited in Upper Klamath Lake, as dissolved inorganic nitrogen usually is depleted below the detection level when algal

production is high, suggesting that nitrogen is the limiting nutrient for algal production (U.S. Army Corps of Engineers 1982).

The maximum pH tolerance found for juvenile shortnose suckers is 9.55 (Falter and Cech 1991), and the minimum critical dissolved oxygen concentration is 0.7 mg/l (Castleberry and Cech 1990). In 1988, few sites with pH values of 9.0 or higher and only sites with dissolved oxygen concentrations between 4.5 and 12.9 mg/l had juvenile suckers (Buettner and Scoppettone 1990). Water quality in Upper Klamath Lake during these summer and fall months can quickly degrade to pH values in excess of 10.0 and dissolved oxygen concentrations as low as 0.3 mg/l (Scoppettone 1986, Bienz and Ziller 1987, Kann pers. comm.). During the summer and early fall months, pH levels have been above 9.5 in most of Upper Klamath Lake on several occasions in recent years (Kann per. comm.) and in June of 1992, pH levels as high as 10.5 were measured in the water leaving the lake through the A-Canal (Schwarzbach per. comm.). When the algae crashes the pH declines, but dissolved oxygen levels usually fall to very low levels (Kann per. comm.). The lake seldom undergoes full stratification in the summer months when water temperatures average 21° C (Bond et al. 1968) and surface water temperatures can reach 30° C (Coleman et al. 1988, Kann pers. comm.). The high water temperatures and the nutrient cycling resulting from lack of stratification are favorable for blue-green algae growth.

Only areas of the lake near inflows from streams or springs maintain relatively low densities of algae and consistently provide the water quality needed to support

the suckers through stressful periods (Kann pers. comm.). Refugial areas of relatively good water quality are important for fish in Upper Klamath Lake during the summer and early fall when dissolved oxygen and pH levels can be stressful or lethal in much of the lake (Coleman et al. 1988). Lost river and shortnose suckers were captured near Pelican Bay, the Wood River, and the Williamson River during summer months of 1986 when water quality was limiting in most of Upper Klamath Lake (Bienz and Ziller 1987). Golden (1969) reported large runs of suckers in the Sprague River during August of 1966 and 1967 which may have been caused by poor water quality in the lake.

The declining condition of Klamath Basin sucker species has been recognized since at least the mid-1960's (Andreasen 1975). Significant losses to the gene pool of the Lost River sucker may in fact have already occurred with the disappearance of entire stocks (e.g., Harriman Springs, Barkley Springs) between the 1960's and the present (Bond pers. comm.). Overharvest may have contributed to the decline. A decline in the average size of suckers harvested in the snag fishery from 1966-1974 indicates that the fishery may have impacted the population. A fish kill in 1971 may also have contributed to the decline in average size. Exploitation estimates in 1984 and 1985 indicated less than a six percent angler exploitation rate for Lost River Suckers, which were the most exploited species due to their larger size (Bienz and Ziller 1987).

Both Lost River and shortnose suckers are long-lived, highly fecund, and well adapted to surviving drought conditions. Infrequent gaps in recruitment will not

adversely affect healthy populations of sucker species with this life strategy (Scoppettone pers. comm.). Because of the inconsistent recruitment, poor age structure of the endangered sucker populations, and low abundance of shortnose suckers and lake spawning populations in Upper Klamath Lake, this biological opinion does not allow for any more than two consecutive years of deviation (for low water years) from the lake levels that would be more conducive for successful recruitment. In low water years a minimum surface elevation of 4137.0 feet through September 30th has been set to provide sufficient access to and volumes of water in refugial areas during the summer months. In normal water years, a lake elevation of 4139.0 feet should provide suitable habitat for the maintenance and enhancement of sucker populations and will improve the chances of reaching the spring spawning water level. Terms of this biological opinion could be renegotiated if more stable age structures and stronger year-classes developed for both endangered sucker species in Upper Klamath Lake.

Recently comparisons have been made between sucker habitat needs at Upper Klamath Lake and Clear Lake. Habitat needs such as depth and access to vegetation in Upper Klamath Lake have been questioned because Clear Lake appears to have relatively stable sucker populations, has virtually no aquatic vegetation, and exhibits wider fluctuations in lake elevations during most years. Aside from the obvious problems of comparing two very different lakes, the main reason that these habitats needs cannot be compared between the lakes is water quality. Clear Lake is very turbid but has good water quality (dissolved oxygen, pH, and other measurement levels are good

throughout the year) and does not have a high nutrient loading problem. Upper Klamath Lake water is relatively clear, except for high densities of algal, but has poor water quality during the summer and fall, apparently due to the high nutrient loads and seasonal algal blooms. When algal production is high, the pH and dissolved oxygen levels can reach lethal levels for fish in much of Upper Klamath Lake (Kann per. comm.). If Upper Klamath Lake had the turbidity of Clear Lake, it would not have high algal production because the limited light penetration would reduce algal and submergent aquatic plant growth. The reduction in algae production should reduce the water quality problems associated with it. The high turbidity would also provide cover and suckers would readily use shallower depths. Suckers may be forced to feed in shallower depths because most of the lakes productivity is usually limited to shallow water in turbid lakes. Both endangered sucker species generally avoid shallow clear water and use deeper water for cover (Scoppettone per. comm.). For example, suckers spawning at Sucker Springs generally move into the shallow water only at night and retreat to deeper water off-shore during the day (Buettner per. comm.). For all of the above reasons, the two lakes can not be compared because the sucker habitat needs are different in the two lake systems.

There has been much concern expressed in the literature over the possible hybridization of the Lost River and shortnose suckers with other sucker species of the area as well as between the two endangered species. However, recent genetic research at the University of California, at Davis and Oregon State University has indicated that "hybridization has not occurred at an appreciable rate"

(Moyle and Berg 1991). The various State and Federal fisheries agencies are presently operating under the assumption that the species are not hybrids (Scoppettone pers. comm.). However, Harris (pers. comm. 1991) points out that "The question of the source of the morphological variation in shortnose sucker populations remains. Analysis of changes in the DNA sequences over time may provide additional insights into questions concerning the taxonomic status of shortnose suckers and the possibility of hybridization and introgression with Lost River and Klamath largescale suckers."

Clear Lake and Gerber Reservoir Populations

Clear Lake and Gerber Reservoirs, and their tributaries, are part of the Lost River system, all of which are within the current or historic range of the endangered suckers. Clear Lake Reservoir has been reported as being the only area where the Lost River sucker and the shortnose sucker occur together in the Lost River system (Koch et al. 1975), but both species are now known to exist in Tule Lake also. The Lost River and shortnose suckers in Clear Lake are the last known sizeable populations in the Lost River system although in 1992 good numbers of shortnose suckers were reported in Gerber and Harpold Reservoirs and numbers of both species are unknown in Tule Lake. Both endangered sucker species likely suffer from competition with the large number of non-native species that have been introduced to Clear Lake.

In the Clear Lake drainage, both Willow Creek and Boles Creek provide habitat for Lost River and shortnose suckers (Buettner and Scoppettone 1991). Both of these

creeks flow primarily through the Modoc National Forest. Willow Creek is also the primary spawning stream for population in Clear Lake, and juvenile suckers have been observed stranded in pools along the stream (Buettner pers. comm.).

A minimum lake elevation of 4524.0 feet during the spawning season has been suggested by the Service in the January 6, 1992 biological opinion and this biological opinion for spawning access to and larval emigration from Willow Creek. A minimum surface elevation of 4523.0 feet is suggested in this opinion for the remainder of each year to provide adequate depths in the east lobe of Clear Lake for foraging and rearing habitat and to reduce risks of desiccation. Total desiccation of the east lobe is nearly certain in 1992 and it's possible that the west lobe could dry up in 1993 if the current drought conditions continue. A minimum surface elevation of 4521.0 feet for the west lobe is suggested to maintain the populations of suckers during extended droughts. A dike was required in the May 1, 1992 biological opinion to be placed between the two lobes to maintain the 4521.0 elevation in the west lobe.

Because of the relatively consistent recruitment, and diverse age structure of the endangered sucker populations in Clear Lake, longer gaps in recruitment can occur at Clear Lake than at Upper Klamath Lake without harm to the present populations. Good water quality allows more consistent recruitment of year classes when Willow Creek flows allow spawning. This biological opinion allows for up to four consecutive years of deviation from the lake levels (for low water years) that would be most conducive for successful recruitment. Clear Lake does not have

the water quality problems that Upper Klamath Lake exhibits, but has less reliable inflows. Extended periods of low lake elevations are more likely in Clear Lake than Upper Klamath Lake. Four years of compromised lake levels would allow both juvenile and adult shortnose suckers and Lost River Suckers to remain in the population and avoid risks to the entire populations if one life stage was threatened.

Little is known about the endangered sucker population inhabiting Gerber Reservoir. In May of 1992, over 200 shortnose suckers, but no Lost River suckers, were collected from Gerber Reservoir. They ranged in size from 78 to 461 mm FL. The presence of smaller suckers indicates that the population of shortnose suckers in Gerber reservoir has successfully recruited in the last few years (Buettner, pers. comm.). Juvenile suckers (less than 100 mm) were observed in Barnes Valley Creek in 1992, indicating successful reproduction in the creek in 1991 (Buettner, pers. comm.).

Gerber reservoir has been drawn down to critically low levels for irrigation releases in the last two years. It is predicted to reach an elevation of only 4796.9 feet (226 surface acres, 937 acre-feet) in October of 1992, which is less than 1% of the reservoirs capacity. Although the reservoir should maintain adequate depth (17 feet) to maintain a population of suckers, and there has been successful reproduction in the last few low water years, the shortnose suckers sampled in April of 1992 showed signs of stress such as low body weight, poor gonadal development, and reduced growth rates of juveniles, which were probably related to low reservoir levels (Buettner pers. comm.). There have been no minimum

surface elevations for Gerber Reservoir set in any previous biological opinions since evidence of endangered suckers being in the impoundment was only recently confirmed (Buettner pers. comm.). This biological opinion requires no water releases below 4799.6 feet (as recommended by Reclamation) to maintain the sucker population through the summer and winter periods. Lost River suckers have not been caught in Gerber Reservoir and may not exist in this impoundment. The BLM operations in the watershed can affect inflow to the reservoir. Reclamation and BLM have an agreement on operations at Round Valley Reservoir that can reduce inflow into Gerber Reservoir, but during drought years when Gerber Reservoir is below 45,000 acre feet, only 600 acre feet of inflow can be held in Round Valley Reservoir. In severe droughts like the present one, Round Valley Reservoir is nearly dry and cannot release water to Gerber Reservoir.

The Lost River and Tule Lake

Because of present water management practices, the Lost River receives no water from Clear Lake during the winter months. In the months of April (Koch and Contreras 1973) and September (Koch et al. 1975), researchers have observed large numbers of fishes, including endangered suckers, stranded in an isolated pool downstream of the Clear Lake Dam. Koch and Contreras (1973) reported three areas from which they captured suckers in their survey of the Lost River, including Harpold Reservoir, the Lost River below River Bridge on the east side of the city of Bonanza, and the Lost River one mile downstream from Crystal Springs Dam. At least three shortnose

suckers have been recorded in Malone Reservoir (Buettner pers. comm.). Surveys conducted in 1992 indicate good recruitment of shortnose suckers in Harpold Reservoir (Buettner pers. comm.). This reach of the Lost River has apparently been successful in maintaining and supporting this population of shortnose suckers. Maintaining adequate depths and volumes of water in these reservoirs may be critical for the survival of suckers in the Lost River during low flow and freezing conditions.

Populations of Lost River suckers and shortnose suckers in Sheepy Lake, Lower Klamath Lake, and Tule Lake, which constitute the downstream terminuses of the Lost River system (Sheepy and Lower Klamath Lake are now connected to the Lost River via the Tule Lake Tunnel), were believed to be extirpated after 1924, when these lakes were drained for farming (Moyle 1976). However, Lost River and shortnose suckers were observed spawning downstream of Anderson-Rose Dam on May 23, 1991. These fishes may have migrated upstream from Tule Lake, where both species have since been found.

Prior to the 1920's, Tule Lake was reduced from an historical 96,000 surface acres of open lake and marsh to only 13,000 acres of water available to the suckers. Tule Lake is now entirely within a National Wildlife Refuge. The lake is hypereutrophic and water quality is marginal for suckers during the summer months. In June and July of 1992, the pH in most of Tule Lake has frequently been above 9.5 (Reclamation unpublished data). Most of the inflow during these months is irrigation return water that has been reused up to 6 times and is of poor quality for fish with high pH and low dissolved oxygen levels (USGS 1991). Dissolved oxygen levels as low as 0.41 mg/l, and

total ammonia levels as high as 0.88 mg/l have been measured in the Lost River going into Tule Lake in June of this year. In situ survival of fathead minnow fry has been very low with no more than two of 20 surviving during any of four separate tests at the same site in the Lost River during June of 1992 (Schwarzbach per. comm). The shallow depth, warm water temperatures, and hypereutrophic condition of the lake promotes algal blooms and limits the amount of water in the lake with acceptable water quality for suckers and most other fish.

During the winter, Tule Lake is drawn down to an elevation of 4033.5 for flood control. Because of the shallow depths at this elevation, only isolated pockets of water with depths greater than three feet exist during the winter. In severe winters with thick ice cover, this shortage of deeper water could limit the number of fish that survive in Tule Lake and increase the risks of winter kills. Winter kills have not been observed in the lake, but low surface elevations in winter could limit sucker abundance. Waterfowl activity keeps some open water in Tule Lake during the winter and may reduce the risk of winter kills. There may be factors other than water quality and depth limiting sucker populations in the lake.

The Tule Lake Irrigation District diverts water from Tule lake and the Lost River for irrigation. Water is also taken from Tule Lake to Lower Klamath Lake via Pump D and the Tule Lake Tunnel. For fish to get to the Klamath River via the Klamath Straits Drain, they would have to pass through at least two additional pumps. These diversions may have a negative impact on the suckers (especially larval suckers) by direct mortality through the pumps, or

mortalities through desiccation, aquatic vegetation control, predation, and poor water quality associated with the canal systems (see the *Incidental Take* section dealing with incidental take in canals). Suckers that do survive these diversions are still lost to the Tule Lake population and probably trapped in systems where they cannot complete their life cycle.

The Upper Klamath River

The shortnose sucker population in Copco Reservoir appears to consist of mostly adults over the age of 16 years (Scoppettone and Vinyard 1991; Maria pers. comm.). Shortnose suckers sampled from the reservoir typically are between 16 and 18 inches in fork length (Beak 1987; Maria pers. comm.). The only small "adult" shortnose suckers sampled from the reservoir were reported by the CDFG (1974), which included four suckers between 7.5 to 8.5 inches in fork length.

Shortnose sucker's congregate in the upper portion of the reservoir in early April prior to beginning their spawning run up the Klamath River (Beak 1987). Most of the shortnose sucker spawning occurs within two miles upstream of the reservoir (Beak 1987). More detailed information about the spawning run and larval migration is given in the biological assessment (USBR 1992)

Recent information obtained from the ODFW (ODFW) (Fortune pers. comm.) indicates that both shortnose and Lost River suckers have been captured in J.C. Boyle Reservoir within the last decade. In addition, ODFW research efforts monitoring instream passage of suckers over Keno and Link River Dams have documented the following:

At Link River Dam in 1989, four Lost River suckers (525-585 mm) and three shortnose suckers (410-465 mm) were observed.

Observations at Keno Dam included four Lost River suckers (480-491 mm) in 1988, four Lost River suckers (520-610 mm) in 1989, three shortnose suckers (221-424 mm) in 1990, and one shortnose sucker (390 mm) in 1991.

Sheepy Lake may support Lost River and shortnose suckers and is connected to the Klamath River via the Klamath Straits Drain and the Ady Canal. Suckers of unknown species were observed in Sheepy Lake in 1988. Suckers from the Klamath River could enter Sheepy Lake from the Ady Canal. It is unknown if Sheepy Lake could maintain a resident population, but it is known to support other fish. Sheepy Creek historically supported large spawning runs, but the creek runs through private property and current water diversions from the creek may preclude successful spawning.

Effects of the Action

The species addressed in this section include the bald eagle and the Lost River and shortnose suckers. The discussion is combined for the sucker species because past and continuing changes in their habitat have had a similar impact on both species.

Bald Eagle

The most important effects of the proposed management regimes on bald eagles will be indirect. These effects are expected to result from changes in prey availability

related to water management strategies. Generally, wet year and average year operations are not expected to result in adverse effects. Effects of single dry years will probably be minimal, but consecutive years of dry year operations may adversely affect breeding territories of the species at Gerber Reservoir and winter foraging habitat throughout the Basin.

Gerber Reservoir

Observations of the interactions between reservoir management and bald eagle reproduction in northern California (USFWS 1992) suggest a pattern that may be repeated at Gerber Reservoir. Reservoir drawdowns during dry year operations may result in temporary increases in forage availability if reduced habitat causes increased concentration of fish populations and higher fish mortality rates. If more drought years follow, lake levels will remain very low and fish populations will continue to decline or stabilize at a lower level. If precipitation increases, the lakes will begin to rise, dispersing the remaining fish population into increasing habitat. It may take one or more spawning years for fish populations to respond to increasing habitat as reservoirs rise. In either case, forage availability is expected to be lower for some time following periods of unusual drawdowns, and this may in turn result in lower reproductive rates among the resident bald eagles.

During the past few drought years, the combination of low inflows and drawdowns associated with irrigation deliveries have resulted in low water levels at Gerber Reservoir. Reservoir storage has not exceeded 70 percent

of capacity since that time, and has dropped to below 10 percent of capacity each year. The resulting reduction in fish habitat is suspected to have reduced fish populations in the reservoir and otherwise reduced forage availability, with resultant effects on eagle reproduction.

Table 1. shows the reproductive history of the two pairs of bald eagles occupying the reservoir. The rate of reproductive failures has been noticeably higher during the period of low reservoir levels. In the five years up to and including 1987, the eagle reproductive rate was 1.14 young per occupied site per year with one failure in seven attempts, while in the years following 1987, the overall reproductive rate was 0.75 young per occupied site per year with four failures in eight attempts. The latter reproductive mean is considerably below the rate of 1.0 young per occupied site per year recommended by the Pacific Bald Eagle Recovery Plan (USFWS 1986).

Successful eagle reproduction at Gerber Reservoir may be influenced by competition for a shrinking forage resource. The second territory at Gerber was established in 1986; both pairs bred successfully in the two years prior to the change in management regime. Since the change, only one pair has been successful in any year.

Information on 1992 reproduction is not yet complete and was not included in the above calculations, but at the date of this opinion, one territory already is known to have failed (Hicks pers. comm.). As required by the 1991 biological opinion (USFWS 1991), a monitoring program was established in 1992, and a supplemental feeding program is being planned in the event it becomes necessary.

Table 1. Reproduction at Gerber Reservoir bald eagle territories (Data from Isaacs and Anthony 1990, and U.S. Bureau of Land Management)

Year	Barnes Valley terr.	North terr.
1983	1	–
1984	2	–
1985	0	–
1986	2	1
1987	1	1
1988	0	2
1989	2	0
1990	0	1
1991	0	1

As discussed above, a number of factors may affect eagle reproduction. The actual cause of the low recent reproductive rate is unknown, and low sample sizes preclude statistical analysis of these data. However, strong circumstantial evidence suggests that reservoir management and resulting lack of forage may have negatively affected bald eagle reproductive rates at Gerber Reservoir in recent years. These observations suggest that during future operations, consecutive years of dry year management regimes may have similar results.

Upper Klamath Lake

None of the proposed actions are expected to adversely affect bald eagles at Upper Klamath Lake, because effects on prey populations are not anticipated to be substantial. Eagle reproduction at Upper Klamath has been within the normal range during the past few years (Isaacs pers. comm.). Because the primary forage species at Upper

Klamath (tui chubs and blue chubs) are spring spawners, they should not be significantly affected by summer and autumn drawdowns.

Klamath Basin Wildlife Refuges and Agricultural Lands

One pair of bald eagles that breed at Mt. Dome are believed to forage primarily on Lower Klamath NWR. Reproduction by this pair has been satisfactory throughout the recent dry years. Effects on this pair would not expected except under the most extreme conditions.

Reduced water deliveries to the National Wildlife Refuges and agricultural lands during dry year operations may affect the quantity and quality of habitat for migratory waterfowl and the availability of small mammals during winter flooding. Some indirect effects on wintering eagles may be anticipated; however, the magnitude of such effects cannot be predicted with existing information. Food stress caused by lower prey populations may force portions of the wintering eagle population to migrate elsewhere. In the worst case, an unknown number of eagles may starve and an unknown number of adult eagles may suffer from lowered condition at the beginning of the breeding season.

Clear Lake

No bald eagle breeding territories are located at Clear Lake. One pair of eagles that breed five miles to the east at Willow Creek may forage at the lake on occasion; this tendency may be reinforced by a general lack of water in their breeding area during dry years (Studinski pers.

comm.). Reproductive data available to the Service is incomplete. Reduction of fish populations in Clear Lake due to dry year operations may adversely affect this pair.

Summary of Effects on the Bald Eagle

In summary, the proposed project may adversely affect bald eagles by altering the forage base for four nesting pairs and their young, and for numerous migratory eagles. This effect may be manifested by any of the following behaviors: failure to lay eggs, failure to complete incubation, starvation of nestlings or fledglings, abandonment of nest territories by adults, or lowered condition among migrants.

Lost River and Shortnose Suckers

Project irrigation will decrease inflows into the lakes and rivers and increase nutrient loading from return flows, which has contributed to the hypereutrophic condition of most of the water in the Upper Klamath Basin (USGS 1991). With the proposed action, Reservoirs and rivers in the Project may be reduced to dangerously low levels during drought conditions. Further reductions in available habitat is unlikely as Reclamation does not anticipate any significant expansion or reductions of the project water demands in the future.

The effects of the Project are not limited to the project area, as decreased flows in the Klamath River and poor water quality from irrigation return water (via the Klamath Straits Drain) could negatively impact downstream water users and aquatic life. Dissolved oxygen

levels as low as 0.0 mg/l, temperatures up to 28.5°C, and pH levels as high as 9.4 were measured in the Klamath Straits Drain in 1991 (Reclamation unpublished data, Schwarzbach pers. comm.). Total ammonia levels as high as 0.94 mg/l have been measured in the Klamath Straits Drain and survival of fathead minnow fry was 0/20 in two of four days of testing at two different sites in the drain during June of 1992 (Schwarzbach per. comm.). Downstream populations of endangered suckers and other listed species could be affected by future Klamath Project actions and/or other cumulative effects.

Looking forward in time, given the current status and trends of the endangered suckers and present state of habitat degradation and impacts to listed species resulting from interrelated activities, the outlook is not optimistic. Long-term survival depends on survival through the next few years. The project is currently in the worst drought year on record and reservoirs are receiving record low inflows. Formally stable populations, such as those in Clear Lake, are now threatened by drought related stresses. Without proposed improvements in water quality and sucker habitat, the future of these suckers is imperiled and the present status of habitat condition makes extinction in most of their current range highly likely.

However, the mitigation measures and reasonable and prudent alternatives described in this Biological Opinion are expected to greatly reduce the risk of extinction, and Reclamation's conservation efforts will be a vital part of the recovery and ultimate downlisting of these species.

Clear Lake Reservoir Endangered Sucker Populations

Implementation of the proposed water releases under Clear Lake drought operations coupled with expected lake level declines from seepage and evaporation will result in several direct adverse effects to Lost River and shortnose suckers. Effects of the 1992 proposed action are addressed in the biological opinion issued May 1, 1992 and are hereby incorporated by reference.

During drought years, irrigation releases, evaporation and seepage will result in a loss of reservoir surface area and hence, a loss of Lost River and shortnose sucker habitat. For example, Reclamation projects that, with irrigation releases, the water surface elevation of Clear Lake Reservoir will drop to 4,518.0 feet (8,500 surface acres) by October 1, 1992. This elevation represents only about 50 percent of the surface area at elevation 4524 feet (17,100 surface acres), which was the minimum surface elevation required in the January 6, 1992 biological opinion. Surface elevations lower than 4524 feet in the months of February and March could reduce access to Willow Creek for spawning. A decrease in water surface elevation will also increase the susceptibility of fishes to predation by pelicans, bald eagles, and other fish-eating birds. The resulting loss of water volume could in turn, result in increased water temperatures throughout the lake and decreased dissolved oxygen concentrations.

The projected water surface elevation of Clear Lake at the end of the irrigation season in drought years potentially may result in winter kill of Lost River and shortnose suckers. Clear Lake freezes in the winter (Studinski pers. comm., Hainline pers. comm.) and concentration of fishes

in a small volume of water under a frozen surface may result in the depletion of dissolved oxygen concentrations and subsequent fish kills. For example, the surface of small reservoirs southeast of Clear Lake are known to develop ice layers as thick as 16 to 18 inches deep (Studinski pers. comm.). However, Clear Lake is a much larger body of water and may react differently during freezing periods.

With an extended drought, Clear Lake has the potential to become completely desiccated or reach elevations incapable of sustaining sucker populations due to factors given in the paragraphs above. This is partially due to natural causes, but the potential has been greatly increased by irrigation releases during the last several drought years.

Gerber Reservoir

Gerber reservoir has been drawn down to critically low levels for irrigation releases in the last two years. Extended periods of low water levels will reduce the sucker populations to carrying capacities at these lower levels and possibly reduce access to streams for spawning. Reservoir elevations sufficient to support fish populations through the critical summer and winter periods have been voluntarily maintained by the Langell Valley Irrigation District and Reclamation in 1991 and 1992, but the threat of longer periods of low water levels and reductions in the shortnose sucker population potentially exists for future years.

Tule Lake

The shallow depth, hypereutrophic condition of the lake, and algal blooms will continue to limit the amount of water in the lake with acceptable water quality for suckers and most other fish with the proposed action. During the winter, only isolated pockets of water with depths greater than three feet exist and in severe winters with thick ice cover, this shortage of deeper water could limit the number of fish that could survive in Tule Lake and increase the risks of winter kills. The proposed action would provide only inconsistent spawning flows in the Lost River.

Water is diverted from the lake and the Lost River for irrigation and also taken from Tule Lake to Lower Klamath Lake via Pumping Plant D and the Tule Lake Tunnel. These diversions may have a negative impact on the suckers (especially larval suckers) by direct mortality through the pumps, or mortalities through desiccation, aquatic vegetation control, predation, and poor water quality associated with the canal systems (see the *Incidental Take* section dealing with incidental take in canals). Suckers that do survive these diversions are still lost to the Tule Lake population and may be trapped in systems where they cannot complete their life cycle. The proposed action is basically no change and therefore current problems are likely to continue.

Upper Klamath Lake and Agency Lake

Upper Klamath Lake and Agency Lake will be considered as one and referred to as Upper Klamath Lake unless stated otherwise.

Implementation of planned water releases likely will directly affect Lost River and shortnose suckers by reducing the extent and quality of spawning, rearing, and refugial habitat in low water years. Reduced late summer and fall water quality conditions existing in Upper Klamath Lake can make much of the lake uninhabitable for Lost River and shortnose suckers (Coleman et al., 1988, Kann pers. comm.). Nutrient and organic matter becomes more concentrated and potential for warmer water temperatures increase as a result of the reduction in lake volume and could promote algal growth. When algal production is high, dissolved inorganic nitrogen usually is depleted below the detection limit, suggesting that nitrogen is the limiting nutrient for algal production (U.S. Army Corps of Engineers 1982). Algal blooms usually occur as water temperatures increase, resulting in high pHs and further declines in dissolved oxygen concentrations. Lower lake elevations would increase the potential for more extremes in lake water temperatures as the lake water volume and depth is reduced. The mean critical thermal maxima for shortnose suckers acclimated to 20°C (68.0° F) is 32.7° C (90.9° F) (Castleberry and Cech 1990). Metabolism in ectotherms, such as fish and invertebrates, is directly correlated with temperature. As temperature increases so does metabolism. Therefore, regardless of whether Lost River or shortnose suckers experience water temperatures that approach their thermal tolerance, they, and the other biota inhabiting the lake, would be increasingly stressed as water temperatures increase and dissolved oxygen capacities concurrently decrease. The increased metabolic respiration

would further reduce the dissolved oxygen level. In addition as lake levels decline, the net supply of dissolved oxygen would proportionally decline and may become too low to support the population of native and introduced fishes inhabiting the lake.

Spawning habitat and access for lake spawning suckers should improve with proposed actions at Barkley Springs and other springs, but this may not mean improved recruitment because most of the mortality may occur beyond the larval life stage. Spring and early summer water elevations may be more consistent and beneficial for sucker spawning purposes due to minimum Upper Klamath Lake elevations required in biological opinions, but the lack of recruitment may negate any increases in spawning success.

The proposed action will initiate several studies that may provide solutions to the present water quality problems. Proposed research may also provide answers for sucker identification, distribution, habitat requirements, and recruitment problems. However, much of the proposed action does not include plans for implementing the solutions to be identified in these studies, nor are there any significant changes (except possibly in drought years) in proposed operations in Upper Klamath Lake relative to operations of the Project in the last 70 years. Changes are needed to improve water quality or at least increase the amount of lake habitat that can support suckers through periods of stressful water quality. Problems with water quality are likely to continue and sucker populations are likely to decline further if the current watershed management practices are continued. Many of these watershed practices that are reducing water quality and quantity are

above Upper Klamath Lake and cannot be directly changed by Klamath Project actions. Changes in watershed practices and water quality are likely to be slow and a rapid recovery of the endangered suckers in Upper Klamath Lake is unlikely.

Copco Reservoir and Other Klamath River Impoundments

Little is known about the sucker populations in the impoundments downstream of Upper Klamath Lake, but Reclamation has committed to investigating these populations. Shortnose suckers in Copco Reservoir are known to spawn in the Klamath River upstream of the reservoir. Irrigation diversions and drought conditions in the Upper Klamath Basin have reduced flows in recent years to less than ideal levels for spawning above Copco Reservoir (Maria pers. comm.) and impacted water quality negatively in all of these downstream reservoirs.

Cumulative Effects

Cumulative effects are those effects of future non-Federal (State, local governments, or private) activities on endangered and threatened species or critical habitat that are reasonably certain to occur within the action area of the Federal activity subject to consultation. Future Federal actions are subject to the consultation requirements established in section 7 and, therefore, are not considered cumulative to the proposed action.

Private landowners along streams tributary to Upper Klamath Lake annually exercise their State of Oregon

rights to withdraw water for irrigation and livestock watering. The total amount of water that is annually withdrawn before it reaches Upper Klamath Lake has not been calculated but is thought to be substantial (Rodgers pers. comm.). It is estimated that about 186,000 acres benefit from diversions (which are believed to be at least 372,000 acre-feet) above the Klamath Project boundaries. Nutrient enriched return flows from these upstream agricultural lands coupled with the reduced flows because of irrigation depletion likely contribute to the eutrophication in Upper Klamath Lake. The resulting lowered water surface elevation and poor water quality in Upper Klamath Lake likely may affect all three listed species considered in this biological opinion. Continued farming of the 20,000 acres of lands adjacent to Upper Klamath Lake which were converted from marshland could have the effect of degrading water quality and influencing refugial conditions adjacent to the lake by the dredging of shoreline areas and irrigation practices.

Agency Lake Watershed Area

Numerous farms and ranches in the Fort Klamath area divert significant quantities of water out of the various streams and springs in the watershed upstream and adjacent to Agency Lake North of Upper Klamath Lake. The natural streams in this area include: Sevenmile Creek, Fourmile Creek, Annie Creek, the Wood River, and Crooked Creek. Additionally, water from various natural springs is diverted to various maintained ditches which supply irrigators in the area. Major ditches conveying water from the natural creeks and springs to the irrigators include: Bluespring, Sevenmile, and Melhase Ditches.

Return flows from these ditches are collected into several canals which connect with and are adjacent to Agency Lake. These canals contain water year around and include: West, Sevenmile, Central, and North Canals among others.

The Meadows Drainage District and many individual landowners divert water through the aforementioned ditches. A more detailed description of these diversions is given in the biological assessment (USBR 1992).

Juvenile Lost River and shortnose suckers known to occur in the Wood River and Crooked Creek, (Markle pers. comm.). It is suspected that some of these sucker species may be spawning in these tributaries to Agency Lake (Markle pers. comm.). In larval distribution and abundance studies at the confluence of the Wood River and Agency Lake in 1991, investigators collected larval suckers indicating that suckers were using the Wood River drainage for spawning habitat (Markle 1992). Depending on how far these spawning fish migrate upstream in the Wood River and Crooked Creek, the adult spawners, embryos, and emerging larvae of these suckers may be impacted by water diversions from these tributaries. If spawning suckers are in downstream reaches of the Wood River and Crooked Creek below the irrigation diversions when water deliveries to the ditch systems are diverted out of the channel, then the spawning behavior of these fish may be disrupted resulting in no sucker spawning in that year.

In their 1991 sucker larval distribution and abundance investigation, Markle (1992) found that larval suckers were emigrating through the lower Wood River into the

confluence with Agency Lake in late July. This corresponds to the approximate peak of water diversion (June-mid August) from the Wood River and Crooked Creek (Sparks, pers. comm.). Therefore, if suckers succeed in spawning within the reaches downstream of the ditch diversions, the embryonic and emergent lifestages would potentially be subject to diversions into canals and fields, reduced flows and resulting elevated water temperatures during incubation and larval emigration.

In addition to the potential direct impacts on sucker populations of the diversion of water into the irrigation ditches upstream of Agency Lake, potential indirect impacts of these diversions are possible. As was previously noted, a large portion of the water diverted to the irrigation ditches is recovered to the ditches as return flows (Sparks, pers. comm.). Depending on land practices, use of fertilizers, herbicides, and other chemicals, the number of reuses, and erosion in the this agricultural area, the water quality (including dissolved oxygen, turbidity, and temperature) of these return flows could range from fair to extremely poor. The return water upon collection in the downstream canals, could then potentially impact the water quality of the marsh and nearshore habitats of larval, juvenile, and or adult suckers or other fishes present. It is known that young life stages of suckers frequent these and other habitats types in Upper Klamath Lake. Vincent (1968) found that approximately 79 percent of suckers sampled in his study areas were collected in either marsh or rocky shoreline habitat as compared to mid-lake sampling locations. Vincent (1968) determined that of approximately 20 miles of shoreline habitat in Agency Lake, 9.5 miles were marsh shoreline

habitat. Markle (pers. comm.) found that in their sampling, Agency Lake was devoid of larval or young of the year suckers after late summer. The inability to collect larval suckers indicates that the larval suckers sampled at the Wood River confluence earlier in the summer had either: migrated out of Agency Lake, there were so few recruited into the Lake that their abundance was minimal and could not be detected by sampling, or that no larval suckers survived in Agency Lake after mid-summer. Nutrient rich irrigation return water from the irrigation ditches on suckers in Agency Lake could result in blue-green algal blooms and anoxic conditions within Agency Lake itself. These noxious blue-green algal blooms and resulting degraded water quality could potentially result in fish kills in Agency Lake during the late summer months and may explain the lack of larval suckers in Markle's 1991 larval abundance study.

Williamson River Drainage

Recent information indicates that there are unscreened diversions on the lower Williamson River in the area of concentrated Larval migration and rearing. These diversions may be reducing recruitment to Upper Klamath Lake of fish produced in the Williamson and Sprague River systems. Agricultural practices in the drainage could have the same effects as those listed above for the Agency Lake drainage.

Sprague River Drainage

Chiloquin Dam

Chiloquin Dam, located just upstream of the Sprague River's confluence with the Williamson River, is estimated to have eliminated more than 95 percent of the potential spawning habitat for the Lost River sucker and shortnose sucker and is considered one of the reasons contributing to the decline of the suckers (Federal Register, Vol. 52, No. 165: 32145-32149). Although fish passage facilities on the dam have been installed, the dam has served as an almost total barrier to the annual spawning migrations for the endangered suckers (Stern, 1990); only a very small percentage of the upstream migrating suckers successfully pass the dam through the existing fish ladder (Bienz, Klamath Tribe, pers. comm.). More detailed information about Chiloquin Dam is given in the biological assessment (USBR 1992).

Blockage of the suckers at the dam during their upstream spawning migration forces the fish to spawn enmasse in the short river reach immediately downstream of the dam. Concern has been expressed that spawning of multiple species within a relatively confined area may cause hybridization, although this has not yet been confirmed. Lost River and shortnose suckers have been observed spawning together below Chiloquin Dam (Dunsmoor per. comm.). Spawning and rearing habitat in reaches downstream of the dam are very likely limited. In addition, mass spawning of the suckers in a confined area close to Upper Klamath Lake may create adverse density-dependent conditions limiting recruitment of larval suckers

(e.g., competition for limited food supply and rearing habitat in confined areas of the lower Williamson River).

If existing fish passage conditions at Chiloquin Dam persist, it will very likely restrict recovery efforts for the endangered suckers.

Agricultural Uses in the Sprague River Drainage

Spawning habitat in the Sprague has been degraded by channelization, sedimentation, increased water temperatures, high nutrient concentrations, and the resulting growth of periphytic algae and aquatic macrophytes. These problems originate in the Sprague River Valley, upstream of the present-day spawning areas, where agricultural activities have degraded the riparian habitat. In addition to the resulting loss of spawning habitat, the Sprague River is a major contributor of excess nutrients to the hypereutrophic Upper Klamath Lake. Long-term success of spawning habitat restoration efforts in this river system depend almost entirely on rehabilitation of the upstream reach of the Sprague River (USFWS, 1992).

Agricultural Diversions from the Klamath River

Agricultural (irrigation) diversions from the main stem of the Klamath River are known to exist in the river reach upstream of Copco Reservoir #1 and the California-Oregon border (Beak, 1987). These diversions provide water for irrigation to a private landowner through a lease of PP's water rights (D. Maria pers. comm.). While these structures are relatively large, they probably to not impede fish passage in this river reach (Shrier pers.

comm.). More detailed information about these diversions are given in the biological assessment (USBR 1992). The timing, volume, and the pattern of use of these irrigation diversions as well as their impact, (if any) on sucker populations are unknown although impacts due to water quality and entrainment are likely. No other agricultural diversions are known in this vicinity (Maria; Shrier pers. comm.).

Other Sources of Potential Impacts

Water quality on the main stem of the Klamath River upstream of the Keno Regulation Dam can at times be degraded due to treated sewage, storm water and non-point source runoff from urban areas of the City of Klamath Falls (Fortune pers. comm.). Lumber mills along the Klamath River near Klamath Falls could also contribute to water quality problems in the river. The impoundment of the nutrient rich waters in the reservoirs are known to contribute to algal blooms within the reservoirs and cause downstream algal nuisance conditions in the river (The Klamath River Basin Fisheries Task Force, 1991). The nutrient loads in these reservoirs and the river are known to be elevated, with 79 percent of the nitrogen and 68 percent of the phosphorus in the Klamath River coming from sources upstream of the Iron Gate Dam (CDWR, 1986, as cited by The Klamath River Basin Fisheries Task Force, 1991).

Except for natural erosion along the banks of the Klamath River, there appears to be no other major source of sediment input to the Klamath River (Maria pers. comm.). The river reach below the J. C. Boyle Dam in Oregon to

the California border was designated as the Klamath Scenic Waterway in 1988. The subsequent reach below the state line to the Copco Reservoir is designated "Wild Trout Waters" by the CDFG (The Klamath River Basin Fisheries Task Force 1991).

Harpold Dam

This dam, located about three (3) miles below the town of Bonanza on the Lost River, is privately owned and operated and provides a pool for the Horsefly Irrigation District and individual farmers to pump from for the purpose of irrigation. Large numbers of suckers have been observed in this area by Koch (1973), and spawning activity was reported in nearby Bonanza Springs by Reclamation (Buettner pers. comm.). The population was reported as consisting of shortnose suckers that resemble those of Clear Lake. No Lost River Suckers have been observed there in recent sampling (Buettner pers. comm.). Spawning habitat exists both upstream and downstream of the flash board dam. The dam has no fish passage facilities.

Harpold Dam creates lake type habitat through the irrigation season and a pool through the winter that would not exist otherwise and allows a population of shortnose suckers to maintain itself in the Lost River. Under drought conditions this population is threatened by low water levels due to irrigation pumping and efforts to maintain this population should be initiated.

Gerber Reservoir Watershed

There are six private water use developments within the Gerber Reservoir Watershed (USBR 1970). These developments are primarily for stock grazing operations. Approximately 13,300 acres of both privately held and Forest Service permitted land are included in these developments. Each of these operations use a combination of dams, reservoirs, and ditches to distribute water or use dikes, ditches and canals to irrigate their lands. Use of these water rights are primarily for pasture, and hay and grain cultivation.

The effects of the impoundment of this water on the Lost River and shortnose sucker are unknown. The water development operations would be expected to reduce flows into the major tributaries to Gerber during the runoff. If flows in these tributaries were significantly reduced, then spawning habitat would be reduced. Additionally, irrigation return water quality is probably poorer (nutrient enriched, elevated temperatures, lower dissolved oxygen). A reduction in the quality of the return flows to both the tributaries and Gerber Reservoir may reduce the suitability of the sucker and bald eagle habitat at the reservoir.

Other Effects

The transportation of hazardous materials by truck and train along the Upper Klamath Basin could result in spills and negative impacts to the listed and unlisted species in the basin's waters. Algae harvesting in Upper Klamath Lake and various Project canals may also result in the take of larval and juvenile suckers. The use of chemicals

such as pesticides, herbicides, and mosquito or "midge" control chemicals could result in negative impacts to listed species throughout the basin. The diversion of water directly from Upper Klamath Lake by private (non-Project) water users may result in the taking of suckers and reduction of habitat.

The Service is aware of no other future or presently occurring non-federal activities within the Klamath Project service area that would affect the Lost River sucker, shortnose sucker, or bald eagle.

These cumulative effects and/or those of the proposed action are likely to reduce appreciably the likelihood of the survival and recovery of the Lost River sucker and shortnose sucker. However, they are not likely to reduce appreciably the likelihood of the endangered/threatened bald eagle to survive and recover.

Incidental Take (Bald Eagles Only)

Section 9 of the Act, as amended, prohibits any take (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct) of listed species of fish or wildlife without special exemption. Harm is defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Under the terms of Section 7(b)(4) and 7(o)(2), taking that is incidental to and not intended as part of the

agency action is not considered a prohibited taking provided that such taking is in compliance with this incidental take statement. The measures described below are non-discretionary, and must be undertaken by the agency.

The Service anticipates that incidental take attributable to the proposed action may result from three situations associated with lowering reservoir levels:

1. Harassment/Harm of adult bald eagles. The specific effects that the Service anticipates will occur as a result of lowering lake levels that may result in harm and/or harassment, and, therefore, incidental taking of adult bald eagles are as follows:

   (a) Decreased prey abundance and/or availability.

   (b) Increased distance between nest locations and foraging areas, and the resulting increased energy demand to procure and transport food to nestlings.

   (c) Reduced shoreline lengths resulting in diminished foraging habitat and increased interspecific and intraspecific competition.

   (d) Increased distance from hunting and feeding perches to foraging areas, thus reducing foraging efficiency.

   (e) Increased concentration among recreational users on smaller surface areas, and resulting restriction of eagle access to foraging areas.

2. Harassment/Harm of nestling bald eagles. The Service anticipates that the adverse effects described in parts 1(a-e) of the above incidental take discussion could reduce the ability of adult bald eagles to properly care for eggs or nestlings, thus resulting in their death or impairment.

3. Harassment/Harm of fledgling, immature, and subadult bald eagles. The Service anticipates that the adverse effects described in parts 1(a), (c), (d), and (e) in this incidental take discussion may combine to harm and/or harass non-breeding bald eagles.

The Service anticipated that the maximum annual incidental take attributable to dry year operations to be a total of 8 adults and 24 bald eagle eggs or young at breeding territories at Gerber Reservoir, Mt. Dome, and Willow creek. In addition, an unquantifiable amount of take may result due to effects on wintering eagles. The following reasonable and prudent measures are necessary and appropriate to minimize the impact of incidental take of bald eagles.

1. Maintain prey base for adult and nestling bald eagles.

In order to be exempt from the prohibitions of Section 9 of the Act, the Reclamation is responsible for compliance with the following terms and conditions, which implement the reasonable and prudent measures described above.

1.(a) Following dry year operations, as needed, restore reservoir fish populations by stocking as soon as water levels are sufficient to maintain them. Fish species must include native species known to be utilized by bald eagles. Coordinate fish restocking programs with the Service and the ODFW.

1.(b) During dry year operations, implement a monitoring program at Gerber Reservoir and Willow Creek to identify instances where intervention in the form of supplemental feeding of adults or rescue of young may be appropriate; and carry out such actions where

appropriate to minimize take. (Due to the remoteness of the site and the low likelihood of take, no monitoring of the Mt. Dome site is required). Such monitoring programs and actions shall be conducted in full coordination with the Service, the U.S. Forest Service, the bureau of Land Management, the ODFW, and the CDFG.

The incidental take statement included in this opinion satisfies the requirements of the Endangered Species Act, as amended. This statement does not constitute authorization for take of listed migratory birds under the Migratory Bird Treaty Act, the Bald and Golden Eagle Protection Act or any other Federal statute.

Reasonable and Prudent Alternative

Regulations implementing Section 7 define reasonable and prudent alternatives as alternative actions, identified during formal consultation, that: (a) can be implemented in a manner consistent with the intended purpose of the action; (b) can be implemented consistent with the scope of the Federal agency's legal authority and jurisdiction; (c) are economically and technically feasible; and (d) would avoid the likelihood of jeopardizing the continued existence of listed species or result in the destruction or adverse modification of critical habitat. A reasonable and prudent alternative with respect to the agency action and the Lost River and shortnose suckers is as follows:

Upper Klamath Lake

1. Reclamation shall maintain water surface elevations in Upper Klamath Lake at not less than 4141.0 feet

and a maximum increase in elevation of one foot from March 1st through April 30th of each year, or until 80 percent of swim-up has occurred, to provide stable spawning habitat and prevent desiccation of deposited eggs at Sucker Springs. The determination of 80 percent swim-up will be made with a Service approved method. The maximum increase in elevation of one foot may be exceeded in any year with the implementation of a Service approved operational plan, and would not count toward the four years of compromise. A minimum surface elevation of 4141.0 feet will be required by May 31st of each year to provide larval and juvenile rearing habitat. Project management generally aims for as high a water level as possible at this time of year, and in most years lake elevations are above 4142.0 feet. A minimum surface elevation of 4139.0 feet must be maintained from June 1st through the end of February of each year to expand refugial habitat through the summer, and improve habitat quantity and availability throughout the year. The 4141.0 and 4139.0 minimum elevations required above may be compromised no more than two consecutive years regardless of the time period, and in no more than four of a ten year period to help maintain the potential for more consistent recruitment and age structure of the sucker populations (see the species accounts section for a more thorough explanation). During years when these elevations are compromised, a minimum surface elevation of 4137.0 feed from June 1st through September 30th must be maintained unless adequate access to, and quantity of, refugial areas can be assured at a surface elevation below 4137.0 feet, especially during periods of stressful water quality in Upper Klamath Lake. This assurance should include access to these areas with at least 18 inches of depth. Both water quality and quantity concerns regarding the refugial areas, as well as

access water depth, should be considered when making elevation decisions. In a year following compromised lake levels, if the following 4141.0 and 4139.0 feet levels required above are met, the year will not be counted as one of the four of ten compromised years allowed. The 1992 irrigation season, beginning October 1991, will be the first year of this regulation and considered one of the four years the minimum surface elevations can be compromised in the initial ten year period.

2. Reclamation shall implement a method to reduce entrainment of larval, juvenile, and adult Lost River and shortnose suckers into the A-Canal within five years of issuance of this biological opinion.

Clear Lake Reservoir

Because of the importance of water quality and quantity (especially in regards to depth) to the shortnose and Lost River suckers in Clear Lake, Reclamation shall:

1. Operate the project to assure a minimum reservoir elevation of 4524.0 feet from February 1st to April 15th of each year to allow access to Willow Creek for spawning and dispersal of returning larval suckers, and a minimum of 4523.0 feet from April 16th to January 31st of each year to provide areas of adequate depths to reduce desiccation, predation and freezing risks. The 4524.0 and 4523.0 elevations may be compromised no more than four years out of a ten year period and no more than four consecutive years in any time period to maintain the stable age structure of the sucker populations (see the species accounts section for a more thorough explanation). In a year following compromised lake levels, if the following 4524.0 and 4523.0 feet levels required above are met, the year will not be counted as one of the four of ten

compromised years allowed. The 1992 irrigation season, beginning October 1991, will be the first year of this regulation and considered one of the four years the minimum surface elevations can be compromised in the initial ten year period.

During years when these elevations are compromised, Reclamation shall make no water deliveries from the west lobe of Clear Lake when surface elevations are 4521.0 feet or less to provide adequate water quantity and quality for summer and winter survival of the endangered suckers. If an extended drought causes more than four of ten years to be compromised (lake elevations less than 4523 before or without any water releases), and the west lobe surface elevation is 4521.0 feet or greater, water releases out of the east lobe could be made. However, if the west lobe surface elevation is below 4521.0 feet, water from the east lobe will be delivered to the west lobe to maintain the highest possible west lobe elevation. Water remaining in the east lobe of Clear Lake then could be released to the Lost River. During years of west lobe elevation at or below 4521.0, no water may be delivered from the east lobe that would compromise west lobe elevations.

2. Develop and implement an aeration system for the dam refuge area referred to in item #5 that would assure adequate dissolved oxygen levels and open water during freezing periods. The Service realizes the potential of the lake to fall below minimum elevations in drought years even if no water is released. During extreme weather conditions access to Clear Lake is difficult and Reclamation will not be held liable for aeration system failures under these conditions. If water quality monitoring indicates that aeration is unnecessary, Reclamation may cease aeration of the eastern lobe with approval of the service.

3. Release no water from Clear Lake for any purpose (other than for an emergency, i.e., for flood control or maintenance of downstream sucker populations) until April 15th or until approximately 80 percent of the larval fish have returned to Clear Lake from the Willow Creek spawning area. This usually occurs under normal conditions by April 15. Water releases could be made prior to April 15th if observations by a fishery biologist, using a method approved by the Service, determines that 80 percent of larval suckers have returned to Clear Lake by an earlier date. This requirement may be deleted when the minimum surface elevations of 4524.0 and 4523.0 feet are compromised.

4. Reclamation will install and maintain a plug between the east and west lobes of Clear Lake by filling in a section of the existing channel to the 4521.0 feet elevation. This plug will be installed during the 1992 irrigation season to reduce the summer evaporation rate and potential for freezing in winter.

5. Following irrigation deliveries, maintain a pool immediately upstream of the dam at a 4522.0 feet surface elevation to provide refuge for at least 1000 adult suckers whenever drought conditions that could threaten the suckers in the west lobe occur.

Gerber Reservoir

1. Reclamation shall make no water deliveries from Gerber Reservoir when surface elevations are 4799.6 feet or less to maintain adequate water quantity and quality for summer and winter survival of shortnose suckers. Reclamation will monitor water quality on a weekly basis when this elevation is reached and provide aeration if necessary.

Tule Lake

1. The project must be operated to assure a minimum surface elevation of 4034.6 feet from April 1st to September 30th of each year to provide suckers spawning access, dispersal of larvae, and rearing habitat. A minimum elevation of 4034.0 feet must be maintained from October 1st to March 31st of each year to assure adequate depths to protect the suckers from predation and freezing. The shortage of depths greater than 2.5 feet in this lake could limit the number of fish that can survive stressful periods such as winters with thick ice or warm summers, even if it does not cause obvious fish kills. The winter elevation may be reduced to 4033.5 feet in years of heavy snow pack and high flood potential (as per Service approved operating criteria). The 4034.0 feet minimum elevation required above may be compromised to a minimum elevation of 4033.5 feet no more than two consecutive years and four of every ten years to allow for low water years. Compromises due to flood control needs will not be counted as one of the four of ten compromised years allowed. Aeration systems must be installed to assure adequate dissolved oxygen levels and open water during freezing periods if surface elevations are below 4034.0 feet. Aeration will not be required unless water quality monitoring in deeper areas of the lake indicates dissolved oxygen levels have been reduced to stressful levels. An alternative to the 4034.0 feet elevation requirement through the winter is to provide an equal or greater amount of water depth through dredging, sump rotation or other methods if approved by the Service. As required in the March 27, 1992 biological opinion, Reclamation shall monitor water quality and provide water from Upper Klamath Lake to improve water quality if needed. If the results of the flood plan study

in mitigation measure number 20 indicate a safety concern, consultation will be re-initiated.

2. A minimum flow of 50 cubic feet per second must be maintained in the Lost River below Anderson-Rose Dam for at least 4 weeks beginning April 1st of each year to allow spawning and return of adults and larval suckers. The flows required for spawning may be compromised no more than two consecutive years and four of every ten years to improve conditions for sucker populations with stable age structures. Reclamation shall also improve spawning conditions in the Lost River below the Anderson-Rose Dam by adding gravel substrate or other methods to improve the spawning habitat conditions.

Incidental Take under Reasonable and Prudent Alternative

Section 9 of the Act, as amended, prohibits any taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct) of listed species of fish or wildlife without special exemption. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Under the terms of section 7(b)(4) and 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking provided that such taking is in compliance with this incidental take statement.

In operating the Klamath Project, the Service anticipates the take and loss of all Lost River and shortnose suckers from Clear Lake and Gerber Reservoir that end up in the

Lost River and any associated water delivery systems or that leave Upper Klamath Lake through the A canal and end up in any of the associated water delivery systems. Also all suckers leaving Tule Lake via pumps or diversions and ending up in associated water delivery systems could be taken. Any suckers in the water delivery systems including canals, drains, fields, headgates, and turnouts could potentially be killed or harmed due to low water quality, chemical vegetation control, entrainment in pumps, increased predation, and desiccation. Any suckers that are trapped in the outlet structure of Gerber Reservoir or Clear Lake dams will be taken when the water flow is stopped. Suckers in the Klamath Project lakes and reservoirs could potentially be killed or harmed if water quality or quantity is reduced to stressful levels. Salvage operations could be required in any of the above situations. Consultation should be reinitiated if take occurs, or is expected to occur, as a result of the project or any interrelated or interdependent activity not specified in this biological opinion.

Additionally, during any salvage operation when suckers longer than 80mm are being moved, the Service anticipates that up to 125 individuals of Lost River or shortnose suckers (total – not each) may be taken. The Service establishes the following reasonable and prudent measures to minimize the impact of incidental take. The measures described below are nondiscretionary, and must be undertaken by Reclamation.

1. Salvage Lost River and shortnose suckers that remain in the canal systems that emanate from Upper Klamath Lake, Clear Lake, Tule Lake, and Gerber

Reservoir after these canals have been drawn down and drained.

2. Salvage Lost River and shortnose suckers from any lake or reservoir in the Klamath Project if water quality or quantity data indicates conditions that threatens the endangered suckers and the Service determines the action is warranted.

3. Reclamation shall implement a long-term plan to prevent and minimize take associated with the Klamath Project.

To be exempt from the prohibitions of Section 9 of the Act, the following terms and conditions, which implement the reasonable and prudent measures described above, must be complied with. All notices, plans, and other documents required below shall be prepared and implemented with the approval of the Service.

1. Reclamation shall conduct an annual salvage of suckers stranded in the canal systems and below outlet structures of dams. A salvage plan must be presented to the Service and appropriate state agencies for their approval prior to any salvage operation. Salvage sites will include all sites that yielded more than 20 suckers (above 80mm in total length) in 1991 salvage operations, and other sites as they are identified. During fall salvage operations from the canal systems, all suckers larger than 80 mm will be transferred to areas specified in Reclamation's salvage plan that must be approved by the Service.

2. Effective immediately, water quality and quantity must be monitored at least weekly, in any Project lake, river, or reservoir known to support endangered suckers, during time periods when those waters would have the potential to require a salvage operation (June through September unless conditions such

as low water levels dictate otherwise). Monitoring sites and methods must be approved by the Service. Water quality must also be monitored at any site used to hold suckers that are salvaged. A salvage plan for any salvage operation necessary before June 1, 1994 must be approved by the Service prior to the salvage.

3. Reclamation, in coordination with the Service and appropriate state agencies, shall develop a salvage plan by June 1, 1994 for all Klamath Project lakes, rivers, or reservoirs with established populations of endangered species that outlines salvage methods and transfer or holding sites. These plans would only be implemented if necessary and approved by the Service. Within three years of the issuance of this opinion, Reclamation shall; (a) complete a comprehensive survey of the Klamath Project service area below Clear Lake, Gerber Reservoir, and Upper Klamath Lake to delineate the location of potential sources of take, i.e., water pumps and diversions in sensitive areas, (b) develop and implement a program to reduce or eliminate this take, and (c) for educational purposes, notify landowners, irrigation districts, etc., that the potential for take exists and advise them of protection afforded listed species under the Act and ways to reduce or eliminate this take. This could involve changing the timing of pumping or diverting water, changing the location of pump intakes or changing the method and location of diversions.

Reporting Requirements:

Upon locating a dead, injured, or sick endangered or threatened species specimen, initial notification must be made to the nearest Service Law Enforcement Office. In

Oregon, contact the U.S. Fish and Wildlife Service, Division of Law Enforcement, District 1, P.O. Box 1910, Klamath Falls, Oregon 97601 (503/883-6900). In California, contact the U.S. Fish and Wildlife Service, Division of Law Enforcement, District 1, 2800 Cottage Way, Room E-1924, Sacramento, California 95825 (916/978-4861. Care should be taken in handling sick or injured specimens to ensure effective treatment and care and in handling dead specimens to preserve biological material in the best possible state for later analysis of cause of death. In conjunction with the care of sick or injured endangered species or preservation of biological materials from a dead animal, the finder has the responsibility to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

The Service is to be notified within three (3) working days of the finding of any endangered or threatened species found dead or injured in the Klamath Project service area. Notification must include the date, time, and precise location of the injured animal or carcass, and any other pertinent information. In Oregon, the Service contract person for this information is Mr. Russell D. Peterson (503/231-6179 and in California, the contact person is Mr. Wayne White (916/978-4613. Any Lost River suckers or shortnose suckers found dead or injured in California shall be turned into the CDFG. The agency contact is Ms. Carla Markmann (916/355-7114),

If, during the course of the action, the amount or extent of the incidental take limit is exceeded, the Federal agency must reinitiate consultation with the Service immediately.

Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. The term "conservation recommdations" is defined as suggestions from the Service regarding discretionary measures (1) to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, (2) conduct studies and develop information, and (3) promote the recovery of listed species. The recommendations provided here relate only to the proposed action and do not necessarily represent complete fulfillment of the agency's 7(a)(1) responsibilities.

1. The Service recommends that Reclamation assist the Klamath Tribe in improving larval rearing habitat in the lower Williamson River.

2. The Service also recommends establishing a population of Lost River suckers in Gerber Reservoir with broodstock from Clear Lake when elevations at Gerber Reservoir improve to more normal levels.

To be kept informed of actions that either minimize or avoid adverse effects or that benefit listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

This concludes formal consultation on proposed action described in the Biological Assessment and modified by Reclamation's memorandum dated September 19, 1991. Reinitiation of formal consultation is required if (1) the amount or extent of incidental take is exceeded, as previously described, (2) the provisions and requirements

under the *Incidental Take* section are not implemented, (3) new information reveals effects of the action that may affect listed species or critical habitat in a manner that was not considered in this opinion, (4) commitments and time lines described in the *Project Description* to offset and avoid project related impacts are not met or adhered to, and/or (5) a new species is listed or critical habitat is designated that may be affected by the action. If you have any questions regarding this opinion, please contact Wayne White of my staff at (916) 978-4613.

/s/ Marvin L. Plenert
MARVIN L. PLENERT

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FACTUAL DATA ON THE KLAMATH PROJECT

IRRIGATION PLAN

The Klamath Project on the Oregon-California border in Oregon's Klamath County and California's Siskiyou and Modoc Counties was one of the earliest Federal reclamation projects. In early 1905, Oregon and California State Legislatures ceded title in Lower Klamath and Tule Lakes to the United States for project development under provisions of the Reclamation Act of 1902. Construction was authorized by the Secretary of the Interior on May 15, 1905, for project works to drain and reclaim lakebed lands of the Lower Klamath and Tule Lakes, to store waters of the Klamath and Lost Rivers, to divert irrigation supplies, and to control flooding of the reclaimed lands. Under provisions of the Reclamation Act, project costs were to be repaid through the sale of water rights to homesteaders on the reclaimed project lands.

WATER SUPPLY

Two main sources supply the water for the Klamath Project. One consists of upper Klamath Lake and the Klamath River, and the other consists of Clear Lake Reservoir, Gerber Reservoir, and Lost River, which are located in a closed basin. The total drainage area which includes the Lost River and Klamath River watersbed above Keno is approximately 5,700 mi^2 (1470 x 10^2 ha).

FEATURES OF THE PROJECT PLAN

LINK RIVER DAM on Link River at the head of the Klamath River and just west of Klamath Falls, Oregon, regulates flow from Upper Klamath Lake Reservoir. This reservoir is a principal source of water supply for the project. The dam is a reinforced concrete slab structure, with a height of 22 ft (7m) and a crest length of 435 ft (133m). The reservoir has a capacity of 735,000 acre-ft (907×10^2 m^2) and is operated by the Pacific Power and Light Company, subject to Klamath Project rights.

GERBER DAM and Reservoir on Miller Creek, 14 mi (23 km) east of Bonanza, Oregon, provides storage for irrigation and reduces flow into the reclaimed portions of Tule Lake and the restricted sump areas in the Tule Lake National Wildlife Refuge. The dam is a concrete arch structure, with a height of 84.5 ft (25.8 m) and a crest length of 478 ft (146 m). The reservoir has a capacity of 94,000 acre-ft (116×10^2 m^2).

CLEAR LAKE DAM and Reservoir on Lost River in California, about 19 mi (31 km) southeast of Malin, Oregon, provides storage for irrigation and reduces flow into the reclaimed portion of Tule Lake and the restricted sump areas in Tule Lake National Wildlife Refuge. The dam is an earth and rock fill structure, with a height of 42 ft (13 m) and crest length of 840 ft (256 m). The reservoir has a capacity of 527,000 acre-ft (650×10^2 m^2).

MALONE DIVERSION DAM on Lost River, about 11 mi (18 km) downstream from Clear Lake Dam, diverts water to serve lands in Langell Valley. The dam and earth embankment with a concrete gate structure, has a height of 32 ft (10 m) and a crest length of 515 ft (157 m).

LOST RIVER DIVERSION DAM on Lost River, about 4 mi (6 km) below Olene, Oregon, diverts excess water to the Klamath River through the Lost River Diversion Channel and thereby controls downstream flow in Lost River to control or restrict flooding of the reclaimed portions of the Tule Lake bed and to regulate sumps of the Tule Lake National Wildlife Refuge. It is a horseshoe-shaped, multiple-arch concrete structure with earth embankment wings. The structure height is 42 ft (13 m) and the crest length is 675 ft (206 m).

LOST RIVER DIVERSION CHANNEL extends from the Lost River Diversion Dam to the Klamath River, a distance of nearly 8 mi (13 km). The channel carries excess water to the Klamath River and also supplies additional irrigation water from the Klamath River by reverse flow from the reclaimed lakebed lands of Tule Lake.

ANDERSON-ROSE DAM on the Lost River, about 3 mi (5 km) southeast of Merrill, Oregon, diverts water to serve the lands reclaimed from the bed of Tule Lake. The dam is a reinforced concrete slab and buttress structure with a height of 23 ft (7 m) and a crest length of 324 ft (99 m).

MILLER DIVERSION DAM on Miller Creek, 8 mi (13 km) below Gerber Dam, diverts water to serve lands in Langell Valley. The dam is a concrete weir, removable crest, and earth embankment wing structure, with a height of 32 ft (10 m) and crest length of 290 ft (88 m).

PUMPING PLANTS. There are 5 major pumping plants with power input ranging from 450 to 3,650 hp (336 to 2722 kW) and capacities from 60 to 300 ft^2/s (1.7 to 8.5

m^2/s), and 40 pumping plants of less than 1,000 hp (746 kW).

CANALS, LATERALS, AND DRAINS. There are 18 canals with a total length of 185 mi (298 km) and diversion capacities ranging from 35 to 1,150 ft^2/s (1 to 33 m^2/s). Laterals total 516 mi (830 km) and drains 728 mi (1172 total km).

TULE LAKE TUNNEL. A concrete-lined tunnel 6,600 ft (2000 m) in length and with a capacity of 300 ft^2/s (8 m^2/s) conveys drainage water from Tule Lake restricted sumps to Lower Klamath Lake.

KLAMATH STRAITS DRAIN. The enlarged 600 ft^2/s (17 $^2/s$) drain conveys drainage water from Lower Klamath National Wildlife Refuge and irrigated land which has been reclaimed from Lower Klamath Lake. The drain, which extends from the State Line Road northwesterly to Klamath River, removes the excess winter flows and the drainage from the lower basin, a closed basin, to the Klamath River.

IRRIGABLE ACRES

The project area includes 233,625 acres (94 545 ha) of irrigable lands of which 204,492 acres (82758 ha) were irrigated by the project in 1979.

SOILS

Soil varies from sandy loam to peaty and clay loams throughout the irrigable areas.

IRRIGATION SEASON

The average irrigation season extends from April through September. The growing season varies considerable from year to year, but averages approximately 120 days from about May 15 to September 15.

PRECIPITATION AND TEMPERATURE

The annual precipitation over the project area averages about 14 in (356 mm). At Klamath Falls temperatures have ranged between recorded extremes of 105 °F (41 °C) and -24 °F (-31 °C). Temperatures average about 67 °F (19 °C) during July and August, 29 °F (-2 °C) during the coldest winter month and about 48 °F (9 °C) for the year.

PRINCIPAL PRODUCTS AND MARKETS

The principal crops grown in this area are cereal grains, alfalfa hay, irrigated pastures for beef cattle, onions, potatoes, and grass seed. The area is noted for the production of malting barley. With excellent rail connections to San Francisco and Portland, both within a distance of 400 mi (644 km) from the project area, the principal markets for agricultural products are in Oregon and California, and adjoining states.

BASIN GEOGRAPHY

The Upper Klamath River Basin as shown on the above map encompasses an area of about 9,500 mi^2 (2460 x 10^2 ha), including the Klamath Project service area. The terrain varies from rugged, heavily timbered mountain

slopes to rolling sagebrush benches and broad flat valleys. Most of the valleys of the basin are high and comparatively flat valleys. Most of the valleys of the basin are high and comparatively flat; the elevation above sea level ranging from 2,600 ft (792 m) in Scott Valley to 5,000 ft (1524 m) in the Sycan Marsh. The highest of the mountains is Mt. Shasta, 14,161 ft (4316 m) above sea level. Forest lands total about two-thirds of the basin area and most of the remaining third is arable land.

HOMESTEAD LANDS

Oregon and California legislation which relinquished state title to project lands, and congressional action which directed the project undertaking, provided for disposition of the reclaimed lands in accordance with the 1902 Reclamation Act. Under provisions of the act, the reclaimed public lands were to be opened for homesteading, subject to water right charges designed to repay project costs. The first public lands were opened for homestead in March 1917, for Unit 3 of the Main Division which included 3,250 acres (1315 ha) of private lands and 2,700 acres (1093 ha) of public lands. The 1917 land opening notice announced a construction charge of $39 per irrigable acre for land already in private ownership and $45 per irrigable acre for unentered public land. Reclaimed lands in the Tule Lake Division were opened for homestead entry under 10 different public notices – the first in 1922 and the last in 1948. In total, about 44,000 acres (18 x 10^2) making up 614 farm units were homesteaded in the Tule Lake Division. The 1922 homestead notice, later recalled, included a construction charge of $90 per irrigable acre. Subsequent land openings in the Tule Lake

Division included a construction charge of $88.35 per acre, contingent on the landowners forming an irrigation district to assume joint liability for construction costs.

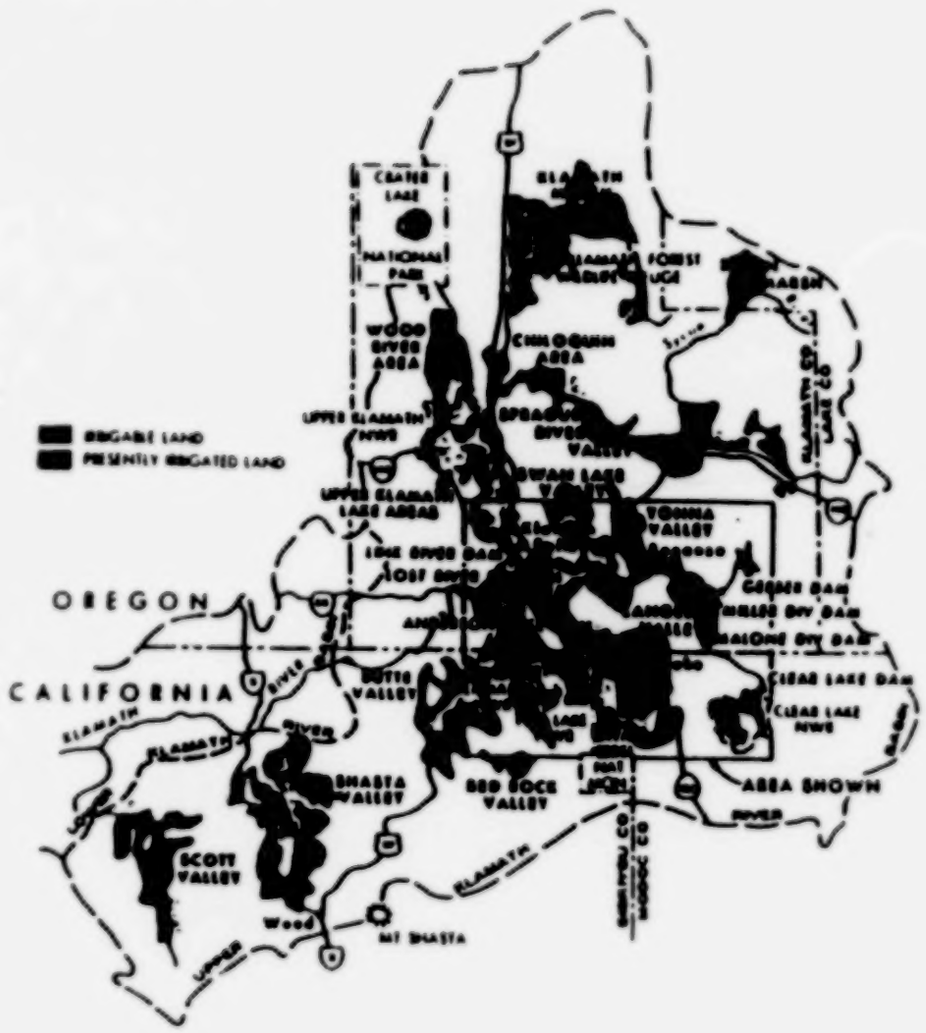
PUBLIC LEASE LANDS

As Tule Lake receded, reclaimed lands were leased for farming before opening to homestead. The practice of leasing served to develop and improve the land during the construction of irrigation and drainage facilities to serve farm units and permit homestead entry. To protect developed homestead lands from flooding, areas at lower elevations were designated as sump areas and reserved for flood control and drainage. Some of the marginal sump acreage subject to less frequent flooding was made available for leasing, but retained in Federal ownership. In addition to providing flood control, the reserved sump areas also preserved existing marsh habitat which has subsequently been included within the basin's national wildlife refuge areas.

NATIONAL WILDLIFE REFUGES

A strategic junction in the routes of the Pacific Flyway, the Klamath Basin annually receives the largest concentration of migratory waterfowl in North America. During migration, the area provides feeding and resting grounds for more than 5 million ducks and geese. By Executive Order in 1906, President Theodore Roosevelt established the Lower Klamath Lake area as the first Federal wildlife refuge for waterfowl in the Nation. Today the Klamath Basin is the site of five national wildlife refuges: the Lower Klamath, Tule Lake, Clear Lake,

and Upper Klamath refuges within the Klamath Project service area, and the Klamath Forest National Wildlife Refuge north of the project area. In addition to wildlife conservation, a key function of the refuge areas is to decrease crop depredation in California's Central and Imperial Valleys. Refuge areas attract and delay the migrating birds during harvest of rice and other valley crops. Provisions for waterfowl management purposes are included in Public Lease Land agreements to provide for the growing of grain and cereal crops for waterfowl forage. The bulk of waterfowl food is gleaned by the birds from the lease lands after harvest. Additional acreage in the refuge areas is farmed by the Fish and Wildlife Service specifically for waterfowl food, nesting habitat, and cover.



RECREATION, FISH, AND WILDLIFE

While migrating waterfowl are the most widely recognized wildlife feature of the basin, a variety of other animals, birds, and fish inhabit the area. Game resources include deer, elk, antelope, bear, and cougar. Furbearers include muskrat, beaver, and mink. Upland game birds include 10 species, most notably doves, pheasant, grouse, and quail. Rainbow trout is the most important game fish

found in relatively large numbers and most sought by fishermen. Basin fishery also includes three other major species of trout, two species of landlocked salmon, and eight species of warm-water game fish. Recreation and tourism the fastest growing industry, ranks third as a contributor to the basin's economy, following agriculture and timber. Sport hunting of waterfowl at refuge public shooting grounds brings into commercial channels substantial sums of money each year. The spectacular sight of millions of ducks and geese, and thousands of other water and marsh birds on the Federal refuges is a prime tourist attraction. Klamath Project reservoirs join other federally administered parks and forest areas as major recreation sites, providing opportunities for fishing, swimming, boating, skiing, camping, and picnicking.

HYDROELECTRIC POWER

By contract executed in 1917, the United States authorized California-Oregon Power Company (now the Pacific Power and Light Company) to construct Link River Dam. The dam, deeded to the United States, is operated and maintained by the power company in accordance with project needs. Under the contract all irrigation rights and requirements are protected and water users of the Klamath Project are provided for as preference power customers. The original contract was amended in 1956 and extended for a 50-year period.

OPERATING AGENCIES

Clear Lake Dam, Gerber Dam, and Lost River Diversion Dam are operated by the Bureau of Reclamation;

Link River Dam is operated by Pacific Power and Light Company; Anderson-Rose Dam is operated by Tulelake Irrigation District; and Malone and Miller Diversion Dams are operated by Langell Valley Irrigation District. Project canals and pumping plants are operated by the various irrigation districts. Recreational facilities at Lower Klamath Lake, Tule Lake, and Upper Klamath Lake are administered by the Fish and Wildlife Service. The Bureau of Land Management administers Gerber Reservoir recreation facilities. Recreation facilities at Malone and Wilson reservoirs are administered by the Bureau of Reclamation. National wildlife refuges in the Klamath Basin are administered by the Fish and Wildlife Service as part of the national wildlife refuge system.

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